(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
16 January 2003 (16.01.2003)

PCT

(10) International Publication Number
WO 03/005192 A1

(51) International Patent Classification[7]: G06F 9/445, 9/46, 11/20, 15/177

(21) International Application Number: PCT/SE02/01353

(22) International Filing Date: 4 July 2002 (04.07.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0102405-8 4 July 2001 (04.07.2001) SE

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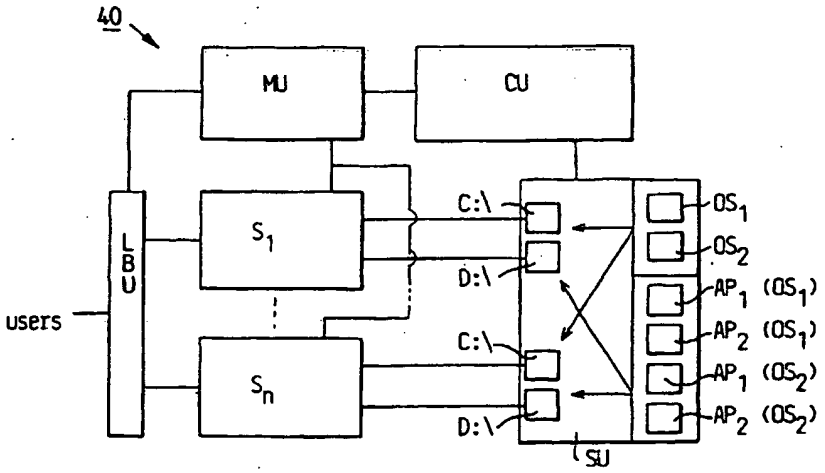
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: A SYSTEM AND A METHOD FOR SELECTING A PRECONFIGURED OPERATING SYSTEM FOR A SERVER



(57) Abstract: In a pool of servers, the capacity may be used in a better way if the servers can be rebooted with different operating systems and provided with different sets of appli-cation depending on the current needs in the network. It may be decided to allocate more machine capacity to an application, remove machine capacity from an applica-tion or move capacity from one application to another. The servers can be allocated dynamically to a particular combination of operating system and applications. Therefore, a service provider can guarantee access to an application at all times without keeping excess capacity at times when the load on the application is low. Also, the service provider does not have to provide a spare server for each combi-nation of operating system and application in case of failure. One spare server can be used to replace different servers depending on the needs at any given time.

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A SYSTEM AND A METHOD FOR SELECTING A PRECONFIGURED OPERATING SYSTEM FOR A SERVER

Technical Field

The present invention relates to an arrangement for use in a computer network for providing at least one service to at least one client computer, as defined in the preamble of claim 1. The invention also relates to a method for use in a computer network for providing at least one service to at least one client computer as defined in the preamble of claim 7 and a computer program product as defined in the preamble of claim 13.

Background and Prior Art

A service provider usually provides different services, such as software applications, to customers using several types of operating systems, such as Windows, Unix, Linux, etc. A customer using a particular operating system cannot normally use a service provided by a server using another operating system. The service provider must therefore provide several servers with different operating systems to provide services to different customers. Supporting only one type of operating system would be less expensive, but would not enable providing services to computers using other operating systems.

The load in a system varies with time. For example, during the night the load is lower than during the day. In most cases the load has a peak of considerably higher load than the rest of the day, during a relatively short time span. The load pattern varies in dependence of the application and also in dependence of other factors. To ensure access to the system at all times, including the peak load, the service provider must ensure a capacity that is higher than what is needed most of the time.

Usually, the service provider also has a spare system in case one of the servers fails and must be repaired. At least one spare server must be available for each supported operating system. This is an expensive solution for securing up-time of the system.

All these tree factors cause the need for keeping excess capacity; that is, an excessive number of servers are idle most of the time.

Another major concern is the security issues. A user accessing the server can perform unauthorized actions that may cause damage to the server and thereby affect the function of the server, which in turn will affect other users currently accessing the same server. This problem does not only apply to service providers as such, but could apply to any entity managing a network having at least one server that is accessed by many users.

Summary of the Invention

It is therefore an object of the present invention to minimize the need for hardware installations while ensuring the capacity needed to meet the requirements on a system at any given time.

This object is achieved according to the invention by an arrangement for use in a computer network for providing at least one service to at least one client computer, said client computer using a first operating system, said arrangement comprising at least a first (S1) and a second server (S2) accessible by the client computer, each of said servers being connectable to a first memory location (C:\), said arrangement comprising:

storage means comprising at least a first (OS1) and a second (OS2) preconfigured operating system stored in such a way that it can be retreived by the at least one server, but cannot be altered by an unauthorized user,

control means for monitoring the function of the at least first and second server,

control means for initiating a reboot of the first server,

control means for selecting an operating system with which to reboot the first server,

control means for downloading the booting information of the selected preconfigured operating system to the first memory location of the first server and booting the server using the downloaded booting information

The object is also achieved according to the invention by a method for use in a computer network for providing at least one service to at least one client computer, said client computer using a first operating system, said arrangement comprising at least a first (S1) and a second server (S2) accessible by the client computer, each one of said servers being connectable to a first memory location (C:\), each one of said first and second server being connectable to storage means comprising at least a first (OS1) and a second (OS2) preconfigured operating system stored in such a way that it can be retreived by the at least one server, but cannot be altered by an unauthorized user, monitoring the function of the at least first and second server,
determining if said first server needs to be rebooted,
if the first server needs to be rebooted, selecting an operating system with which to reboot the first server,
downloading the booting information of the selected preconfigured operating system to the first memory location of the first server and
booting the server using the downloaded booting information

The object is also achieved according to the invention by a computer program product for use in a computer network for providing at least one service to at least one client computer, said client computer using a first operating system, said arrangement comprising at least a first (S1) and a second server (S2) accessible by the client computer, each of said servers being connectable to a first memory location (C:\), said first and second server being connectable to first storage means comprising at least a first (OS1) and a second (OS2) preconfigured operating system stored in such a way that it can be retrieved by the at least one server, said computer program product comprising code means which, when it is executed in a computer, will make the computer perform the following functions:

determining if said first server needs to be rebooted,
if the first server needs to be rebooted, selecting an operating system with which to reboot the first server,
downloading the booting information of the selected operating system to the first memory location of the first server and
booting the server using the downloaded booting information

With the inventive arrangement, method and program the preconfigured operating system for a server can easily be restored or changed depending on the need of the users. The number of servers running a particular operating system can be easily adapted to the need at any given time.

Preferably the arrangement further comprises storage means comprising at least a first and a second version of a first application, said first version being adapted to the first operating system (OS1) and said second version being adapted to the second operating system (OS2),
control means for selecting the version of said at least one application adapted to the selected preconfigured operating system to be downloaded to the first server, said application being
control means for downloading and installing the at least one application to the first memory location of the first server .

In this embodiment the method further comprises the steps of
selecting the version of said at least one application adapted to the selected preconfigured operating system to be downloaded to the first server,
downloading and installing the at least one application to the first memory location of the first server

Further, the code means of the computer program product is arranged to make the computer perform the following steps:

selecting the version of said at least one application adapted to the selected preconfigured operating system to be downloaded to the first server,

downloading and installing the at least one application to the first memory location of the first server.

In this embodiment, one or more applications may be provided to the server after rebooting the server, so that the server can provide a particular set of applications to users accessing the network. This makes the system more flexible regarding the capacity for providing different applications. Since the peak load may occur at different times depending on the type of application, several applications can share a pool of servers. The peak load times also vary geographically, because of the time zones. The excess capacity can be allocated to the application that currently has a peak. When the load changes, the excess capacity can be allocated to another application currently experiencing a peak.

In a preferred embodiment the arrangement also comprises a load balance unit (LBU) connected to each of the servers, for directing new users to one of the servers.

The decision to reboot one or more servers may be taken in dependence of the load in the network. The operating system and, if applicable, application or applications, may be selected in dependence on the load in at least one of the servers.

A service provider typically signs a service level agreement with a customer, i.e. a content provider, where the service provider offers to ensure access through the Internet to the content provider's services. With the arrangement and method according to the invention, the servers can be allocated dynamically to a particular combination of operating system and applications. Therefore, a service provider can guarantee access to an application at all times without keeping excess capacity at times when the load on this particular application is low. Also, the service provider

does not have to provide a spare server for each combination of operating system and application in case of failure. Instead, the same spare server can be used to replace different servers depending on what is needed at any given time. In other words, fewer spare servers are needed than the supported number of operating systems, which in turn will reduce the cost for providing redundancy functionality for the system.

Another advantage is that the servers may be rebooted on a regular basis with an uncorrupted preconfigured operating system to minimize the danger of malfunction in the servers caused by user violation etc.

In this document the term "machine" means either a hardware unit having certain properties, such as an operating system and support functions for an application, or a virtual machine existing on one or more hardware units. Further, several virtual machines can share the same hardware.

The invention therefore takes advantage of the fact that different applications have different requirements for machine resources. According to the invention three different types of decision may be made:

Decisions to allocate more machine capacity to an application
Decisions to remove machine capacity from an application
Decisions to move capacity from one application to another

These decisions may be based on one or more of the following criteria, or other criteria:

- The number of users of a particular application. If there are many users, or the number of users is increasing, the hardware resources allocated to the application may have to be increased. If there are few users, or the number of users is decreasing, it may be possible to reduce the hardware resources allocated to the application.

- The response time for the application. If the response times for an application are long, it may be necessary to increase the machine capacity allocated to the application.
- The number of machines currently allocated to the application. A maximum or minimum number may be specified in the level of service agreement, or may be made dependent on the load.
- The geographical location of the application
- The logical location of the application
- The load on a particular machine. If the load is high, the possibility to allocate more resources to the applications running on this machine should be investigated. If the load is low, it should be considered whether to set part of the machine resources allocated to the application in standby mode instead, or to allocate the machine resource to another application.
- Security alarm on a physical or logical machine. In this case the machine may have to be taken down, which means that it should be replaced by another machine if necessary.
- Time in operation. A reboot can be performed automatically after a certain uptime.
- Planned events, such as backup or maintenance, may call for a reallocation of applications to another machine.
- An operator may decide to allocate machine resources to an application, to remove machine resources from an application or to move machine resources from one application to another.
- An indication of an increase or decrease in the need for resources.
- An indication of excess capacity for a particular application may lead to a reduction in the hardware machines allocated to the application. The hardware removed from the application may be put in standby mode or allocated to another application.

- The time for releasing a machine may be taken into account. If it would take a very long time to make a machine ready to be taken down, it will in most cases be better so choose another machine.
- The time for starting a new application may also be taken into account when deciding whether to start the application or not.

Some or all of these criteria may be specified in a service level agreement, as mentioned above. For example, the service provider may guarantee a maximum response time at any given time. The service level agreement can also specify a maximum capacity that is to be guaranteed regardless of the load.

The result of any of these decisions can be a request for the allocation of a new machine resource to an application. It can also be a request to remove a hardware resource with or without allocating it to another application. Allocation of resources can be denied, for example because the maximum amount of resources specified in the service level agreement has already been allocated.
For any of these decisions a message may be sent to the customer.

Brief Description of the drawings

Fig. 1 shows a first embodiment of a system according to the present invention.
Fig. 2 shows a second embodiment of a system according to the present invention.
Fig. 3 shows a third embodiment of a system including two servers.
Fig. 4 shows a fourth embodiment of a system including an undefined number of servers.
Fig. 5 shows a flow chart of a method for rebooting a server according to an embodiment of the invention.
Fig. 6 shows a flow chart of a method for rebooting a server, including moving users according to an embodiment of the invention.
Fig. 7 shows a flow chart of the third embodiment of the present invention.

Detailed description of preferred embodiments

Figure 1 shows a first embodiment of a system 10, including a server S1, having a first memory location C:\, the C drive, which may be a separate hard drive or a partition of a hard drive. The server is connected to a control unit CU, and to a storage unit SU. The storage unit may contain memory circuits, hard drives etc. The purpose of the storage unit is to store selected information that must be accessible to the system 10. The control unit CU is also connected to the storage unit 20 SU. The first memory location C:\ may also be located in the storage unit SU, as shown in fig. 2.

A plurality of users may access the server S1 and store user information, such as documents, presentations, etc, at a predetermined location H:\ (H drive) in the system. The user information may be stored in the server S1 (not shown) in a separate or as a partition of a hard drive, but is preferably stored outside the server, e.g. in the storage unit SU, as indicated by H:\ in Fig. 1, or in a separate file server (see fig. 2). Each user will only see the drives that the server 51 has mapped up, in this example C and H drive.

The storage unit SU includes a second memory location comprising booting data of a plurality of preconfigured operating systems OS1, OS2, in this example two standard operating systems, each being preconfigured with a specific type of applications, such as word processing applications. Examples of standard operating systems are MS Windows NT, Linux, Unix etc. The second memory location may also be implemented in the server S1 as one or several separate hard drives (not shown).

The users will not have access to the second memory location, to avoid any accidental or intentional damage to the server S1.

Figure 2 shows a second embodiment 20 of the present invention including a server S1, a control unit CU, a storage unit SU, a separate file server FS and a monitoring unit MU. The first memory location C:\ is, in this embodiment located in the storage

unit SU together with the preconfigured operating system OS1, OS2 in the second memory location. The control unit CU is connected to the storage unit SU and the monitoring unit MU. The server S1 is connected to the monitoring unit MU, the storage unit SU and the file server FS.

The monitoring unit helps the control unit CU to monitor the number of users accessing the server, monitor the load in the server, measures the up-time of the server, monitor any accidental or voluntary unauthorised action in the server by monitoring data consistency and/or detecting server data intrusion, etc. The control unit may also control the server S1 via the monitoring unit MU.

Figure 3 shows a third embodiment 30 of the present invention comprising two servers S1 and S2. Both servers are connected to a load balance unit LBU, which controls the users access to each server, as described in more detail below. Each server is also connected to a storage unit SU, where the first memory location C:\ of each server is located. The storage unit SU has, in this example, booting data for three different preconfigured operating systems OS1, OS2, OS3 for each server S1, S2.

As described in connection with figure 2, the system is also provided with a monitoring unit MU and a control unit CU, connected to the storage unit SU and the monitoring unit MU. The monitoring unit MU is also connected to each server and to the load balance unit LBU. The function of the load balance unit is well known in the field, and it assists with directing new users to an appropriate server. The access to a server for new users may easily be controlled by the load balance unit. A new user will be directed to a particular server offering the desired service with the appropriate operating system. If more than one server fulfils the requirements, the load on each of these servers will be considered when directing the user.

The embodiment 30 is also provided with means to store user information, such as a file server or similar, but since this is not a part of the invention it is not shown for the sake of clarity.

Figure 4 shows a fourth embodiment of the present invention, comprising a large number of servers (S1-Sn), n=6, n is larger than 1, all connected to the load balance unit LBU, as described in connection with figure 3, and to the storage unit SU. The function of the control unit CU and the monitoring unit MU is as described above, but the storage unit SU in this embodiment comprises a third memory location storing information regarding different applications for each standard operating system, In this example there are two different types of application configurations for each operating system: AP1(OS1), AP1 (OSl), AP2 (OS2), and AP2 (OS2). Examples of application configurations may be Word processing applications, database applications, Economy applications, etc. Alternatively, for service providers on the internet, the applications may be e-commerce applications, games or other programs, or applications providing information, such as news services.

In figure 4 only two servers are shown, but the dotted line between them indicate that there may be more server, and in this example n is assumed to be 6. Servers S1-S4 are the primary servers where the servers S1 and S2 have a first standard operating system OSl, e.g. MS Windows NT, and the servers S3 and S4 have a second standard operating system OS2, e.g. Linux. Servers S1 and S3 are preconfigured with applications APl of a first type and servers S2 and S4 are preconfigured with applications AP2 of a second type. This way the system provides support for two different standard operating systems, each having two application configurations. The load balance unit only directs the users to the appropriate server meeting the need of each user.

Servers S5 and S6 are maintained as spare servers, in case one of the primary servers S1-S4 breaks down or if there is an unexpected peak load for a specific applica-

tion in one standard operating system, e.g. AP1(OS1) word processing applications using Linux. If the load on the server S1 becomes too high, one of the spare servers S5 may be configured to provide the same service. In this case, the spare server S5 is booted using OS1 and AP1, as will be discussed in detail in connection with Fig. 7.

A flow diagram, shown in figure 5, describes the method for selecting a preconfigured operating system in the embodiments shown in Figures 1 and 2, that is, when selecting only an operating system.

The process starts in step 50

Step S1: The control unit CU selects a preconfigured operating system (OS1 or OS2). This selection may be determined in several ways, as will be discussed below.

Step 52: The next step of the process to reboot the server is to copy the booting data of the selected preconfigured operating system from the secure second memory location to the first memory location C:\.

Step 53: The server boots up by using the uncorrupted data that was copied to the first memory location C:\.

The flow ends in step 54.

The most obvious use of the process shown in Figure 5 is to reboot the server S1 regularly by measuring the up-time of the server. When a first predetermined time has passed, preferably less than 1 hour, e.g. 10-15 minutes (but the predetermined time may be extended to be up to for instance 100 hours or more), a flag is set in the control unit CU, indicating that the server should be rebooted as soon as possible. This is preferably performed when no users are accessing the server S1. If there are users accessing the server all the time, and the up-time of the server passes a second predetermined time, e.g. twice as long as the first predetermined time, a second flag may be set in the control unit CU, indicating that a request should be sent to the present users to log out and that no new users may be logged on to the server, The re-

booting will take place as soon as the users have logged out or after a predetermined time, e.g. 10 minutes, after the request is sent, thereafter throwing out any users that have not logged out yet.

If the control unit detects an accidental or voluntary unauthorised action in the server, e.g. someone tries to get unauthorised access to the server the server is shut down immediately and the users are thrown out, to minimise the damage the intruder may achieve. The control unit thereafter selects the same preconfigured operating system as before to reboot the server using uncorrupted booting data. The server may also be rebooted for other reasons, for example, to change the operating system.

If a privileged user has access to the server, the user may request a change of preconfigured operating system, thereby causing the control unit CU to select the desired preconfigured operating system and rebooting the server after the user has logged out from the server.

Figure 6 is a flow chart describing the process of the invention, applied to the embodiment shown in Figure 3.

The process starts in step 60 and proceeds to step 61.

Step 61: The servers S1 and S2 are monitored by the monitoring unit MU, measuring up-time, number of users, load, unauthorised use etc. of each server, as described in connection with figures 1 and 5.

Step 62: The control unit CU uses the information obtained in step 61 to determine if a server needs to be rebooted and which preconfigured operating system should be used.

The decision regarding whether any server should be rebooted is taken in this step, which will be discussed in more detail below. If there is no server to reboot, the process returns back to step 61, where the monitoring

unit continues to monitor the servers. If the control unit CU makes a decision to reboot a server the process continues to step 63.

Step 63: The control unit removes present users from the selected server by performing the following:

1) send an order to the load balance unit, via the monitoring unit, to direct new users to an alternative server having the same operating system as the server being shut down. If no alternative server is available, the control unit may boot a spare server (not shown), by using the process described in connection with figure 5, to create a server with the same preconfigured operating system as the one that should be shut down and rebooted. If there is no spare server available, new users will be denied access to any server until the server is rebooted.

2) Wait until present users, accessing the server, are logged out or, if more urgent, send a request to the present users to log out as soon as possible or, if extremely urgent, throw out present users. This is indicated in box 63a and 63b, where a decision is made in box 63a to proceed to box 63c if no users are logged on to the server or if an urgent need to throw out present users has occurred (priority changed). On the other hand if there are still users present on the server and the priority is not changed, a notification is sent to the users requesting that they should log off, see box 63b. An alternative solution is to hand over present users and their running applications to an alternative server (if available),

3) Shut down the server.

When the server is shut down in box 63c, the process continues to step 64,

Step 64: A preconfigured operating system is selected, as will be discussed in more detail below.

Step 65: The booting data needed to reboot is copied from the uncorrupted second memory location to the first memory Location C:\ of the server.

Step 66: The server is booted using the booting data stored in the first memory location C:\. The process returns back to step 61 after the server has been booted up.

Steps 62 and 64 are essential for determining if a server should be rebooted and which operating system should be installed during the rebooting process. These steps are preferably implemented in a rule matrix, where the input parameters may be up-time, number of users, load and unauthorised use and/or others, as discussed above. By combining the decision of the rule matrix with the change of load on the input to the servers appropriate measures may be taken. The taken measures always depend on the result from the monitoring process of the servers.

A server should be rebooted with the same preconfigured operating system if, for instance, the up-time has exceeded a predetermined time, as described earlier, or if an unauthorised use has been detected.

A server should be rebooted with another preconfigured operating system if, for instance, there is a need for more capacity in another preconfigured operating system. A such example could be when the number of users and/or the load of a server exceed a predetermined level. If there is no spare server available, the server having a low number of users is selected to be rebooted with another preconfigured operating system to increase the capacity. The present users of the server being rebooted, may be transferred to another server, if available, or thrown out if the need is urgent.

Users will be denied access to the server if there is an escalating trend in number of users etc., which indicate that the capacity in the other preconfigured operating system will not be sufficient in a near future, and the server is rebooted to increase the capacity.

Figure 7 is a flow chart of the method according to the invention, applied to the embodiment shown in Figure 4. The following will happen in case of a failure in one of the primary servers, e.g. server S3.

The process starts at step 70 and proceeds to step 71.

Step 71: The monitor unit MU monitors all 20 servers (S1-Sn) as described earlier. When server S3 fails the monitor unit registers this and alerts the control unit CU.

Step 72: A decision to boot up one of the spare servers, e.g. S5, is taken, since the server S3 may be experiencing a hardware failure.

Step 73: Any present users are removed from the server S3. This may be done rapidly if needed or during a longer period of time as described in connection with Fig. 6 and the server is shut down in box 73a.

Step 74: A standard operating system is selected, in this example OS2,

Step 75: The booting data of the selected standard operating system is copied from the second memory location to the first memory location of server S5. In this example there is only provided a second memory location for all the servers. This saves memory space and makes it easier to update the different operating systems.

Step 76: An application configuration, in this example AP1(OS2), is selected to replace the server S3.

Step 77: This information regarding the selected application configuration is thereafter copied to an additional memory location D:\.

Step 78: The server is thereafter booted using the booting data from the C drive and the application configuration on the D drive. The process returns back to step 71.

When the spare server is up and running, any new users requiring the second type of operating system for the first type of applications, i.e. AP1(OS2), are directed to server S5 by the load balance unit, which is controlled by the control unit CU via the monitoring unit MU. No new users are directed to the failing server S3.

As may be seen from this example there is no need to provide a separate spare server for each server having a specific operating system and application configura-

tion. Only one spare server is needed, but preferably half as many spare servers as primary servers should be provided to provide a higher quality-of-service level.

Another advantage with this system is that it reduces the energy consumption, since fewer spare servers are needed, and the servers are used in a more cost efficient and environmentally friendly manner, since a spare server may substitute a number of different servers.

Figure 7 may also be used when illustrating what happens during an unexpected peak load, that is, when the capacity for a particular application should be increased.

Step 71: The monitoring unit indicates that a specific server, e.g. server S2, experiences a number of users exceeding a predetermined level, e.g. 400 users.

Step 72: If there are any spare servers available in idle mode, the control unit CU decides to boot up (at least) one spare server. In this example only S6 is available and idle, since S5 has previously taken over the workload of server S3, which has failed.

Step 73: If necessary, users are removed from the spare server. In this case, no users have to be removed from the spare server S6 and the server does not need to be shut down in step 73a.

Step 74: If the control unit CU has not already selected the operating system, in this example OS1, this is done here.

Step 75: Then the booting data is copied from the second memory location to the first memory location of server S6.

Step 76: If the application configuration has not already been selected, in this example AP2, this is done here.

Step 77: The application configuration is copied to the additional memory location D:\ in step 77.

Step 78: The spare server S6 is thereafter booted up using the booting data from the C drive and the application configuration on the D drive.

The process returns back to step 71.

If there are no available idle spare servers, any other server being idle, i.e. having no users, may be reconfigured by first shutting down the server and rebooting the server with the desired operating system and application configuration.

A flexible system has thus been achieved where it is possible to change the operating system of any server, reboot a server that has a long up-time on a regular basis, meet peak load, reduce the number of back-up servers and increase the security of a server system.

The described invention may be implemented as a server sharing system for a service provider having a large number of servers to fulfil the need and requirements of the clients, but the invention should not be limited to this. It is fully possible to implement the invention in any network where there is a need to regularly reboot the server(s) and sometimes even to change the operating system of a server, such as a company network.

The invention also has the advantage that the life span of a server is increased due to the cycling of the servers (rebooting due to long up-time) and it also increases the security of the system since an uncorrupted version of the preconfigured operating system is downloaded each time the server is rebooted.

In this description the word "users" is intended to cover both persons and machines using the resources and services provided by the servers. The methods described above are preferably implemented as a software application that generally includes instructions to carry out the method steps described in connection with figures 5, 6 and 7. The software application is preferably stored in the control unit CU during operation, but may naturally be provided on a CD-ROM, diskettes or other memory storage media, which the control unit may access for running the application.

In all the embodiments discussed here, the function of the control unit, the monitoring unit and the load balance unit is controlled by computer programs run on the appropriate unit.

Claims

1. An arrangement for use in a computer network for providing at least one service to at least one client computer, said client computer using a first operating system, said arrangement comprising at least a first (S1) and a second server (S2) accessible by the client computer, each of said servers being connectable to a first memory location (C:\), said arrangement comprising:

storage means comprising at least a first (OS1) and a second (OS2) preconfigured operating system stored in such a way that it can be retreived by the at least one server, but cannot be altered by an unauthorized user,

control means for monitoring the function of the at least first and second server,

control means for initiating a reboot of the first server,

control means for selecting an operating system with which to reboot the first server,

control means for downloading the booting information of the selected preconfigured operating system to the first memory location of the first server and booting the server using the downloaded booting information

2. An arrangement according to claim 1, further comprising

storage means comprising at least a first and a second version of a first application, said first version being adapted to the first operating system (OS1) and said second version being adapted to the second operating system (OS2),

control means for selecting the version of said at least one application adapted to the selected preconfigured operating system to be downloaded to the first server, said application being

control means for downloading and installing the at least one application to the first memory location of the first server .

3. An arrangement according to claim 1 or 2, further comprising a load balance unit (LBU) connected to each of the servers, for directing new users to one of the servers.

4. An arrangement according to any one of the preceding claims, further comprising control means arranged to initiate a reboot of said first server in dependence of the load in the network.

5. An arrangement according to any one of the preceding claims further comprising control means arranged to select an operating system in dependence on the load in at least one of the servers.

6. An arrangement according to any one of the claims 2-5, further comprising control means arranged to select the version of the application in dependence on the load on at least one application in the server.

7. A method for use in a computer network for providing at least one service to at least one client computer, said client computer using a first operating system, said arrangement comprising at least a first (S1) and a second server (S2) accessible by the client computer, each one of said servers being connectable to a first memory location (C:\), each one of said first and second server being connectable to storage means comprising at least a first (OS1) and a second (OS2) preconfigured operating system stored in such a way that it can be retreived by the at least one server, but cannot be altered by an unauthorized user, monitoring the function of the at least first and second server,
determining if said first server needs to be rebooted,
if the first server needs to be rebooted, selecting an operating system with which to reboot the first server,
downloading the booting information of the selected preconfigured operating system to the first memory location of the first server and

booting the server using the downloaded booting information

8. A method according to claim 7, wherein said servers are connectable to storage means comprising at least a first and a second version of a first application, said first version being adapted to the first operating system (OS1) and said second version being adapted to the second operating system (OS2),
said method further comprising the steps of
selecting the version of said at least one application adapted to the selected preconfigured operating system to be downloaded to the first server,
downloading and installing the at least one application to the first memory location of the first server

9. A method according to claim 7 or 8, further comprising the step of determining the need for reboot in dependence on the load in the network.

10. A method according to any one of the claims 7-9, further comprising the step of selecting the operating system with which to reboot the first server in dependence of the load on at least one of the operating systems.

11. A method according to any one of the claims 8-10, further comprising the step of selecting the version of the application in dependence of the load on the at least one application.

12. A method according to any one of the claims 7-11, further comprising the step of directing a user accessing the network to one of said servers by means of a load balancing unit (LBU).

13. A computer program product for use in a computer network for providing at least one service to at least one client computer, said client computer using a first operating system, said arrangement comprising at least a first (S1) and a second

server (S2) accessible by the client computer, each of said servers being connectable to a first memory location (C:\), said first and second server being connectable to first storage means comprising at least a first (OS1) and a second (OS2) preconfigured operating system stored in such a way that it can be retrieved by the at least one server, said computer program product comprising code means which, when it is executed in a computer, will make the computer perform the following functions:

determining if said first server needs to be rebooted,

if the first server needs to be rebooted, selecting an operating system with which to reboot the first server,

downloading the booting information of the selected operating system to the first memory location of the first server and

booting the server using the downloaded booting information

14. A computer program product according to claim 13, wherein said network further comprises storage means comprising at least a first and a second version of a first application, said first version being adapted to the first operating system (OS1) and said second version being adapted to the second operating system (OS2), said code means being arranged to make the computer perform the following steps:

selecting the version of said at least one application adapted to the selected preconfigured operating system to be downloaded to the first server,

downloading and installing the at least one application to the first memory location of the first server

15. A computer program product according to claim 13 or 14 wherein the code means will initiate a reboot of the first server in dependence of the load in the network.

16. A computer program product according to any one of claims 13-15, wherein the operating system will be selected in dependence of the load on at least one operating system.

5

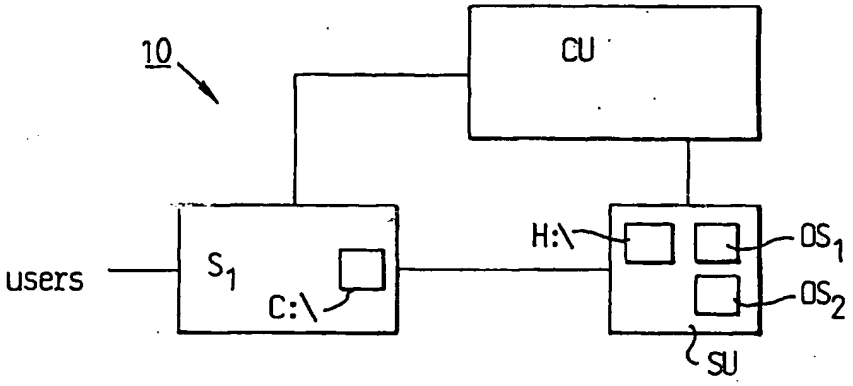

FIG.1

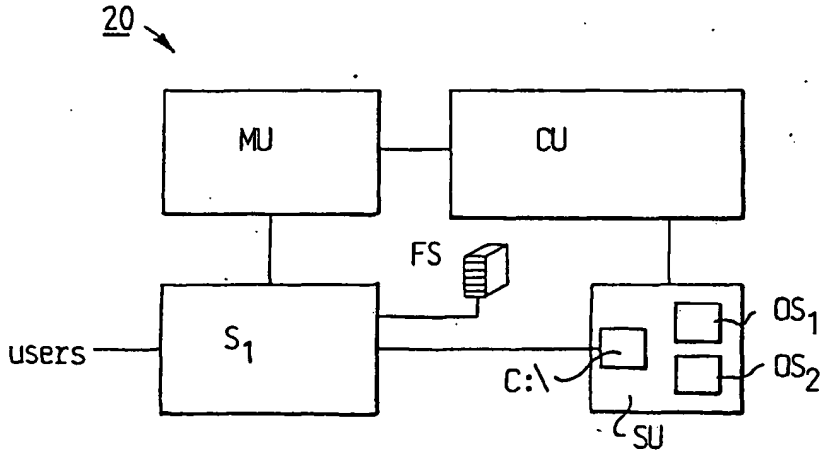

FIG.2

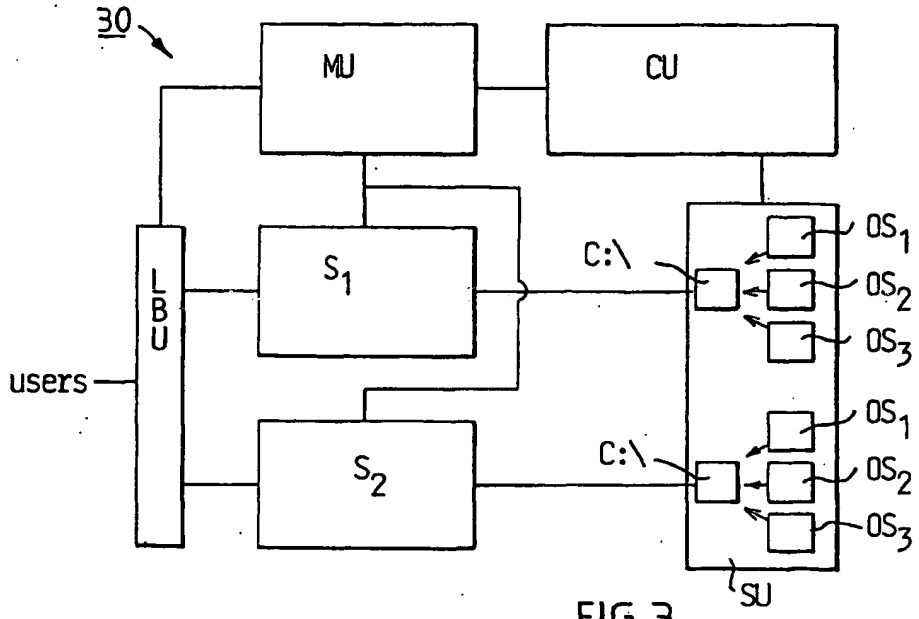
30
MU
CU
LBU
users
S_1
S_2
C:\
C:\
OS_1
OS_2
OS_3
OS_1
OS_2
OS_3
SU

FIG. 3

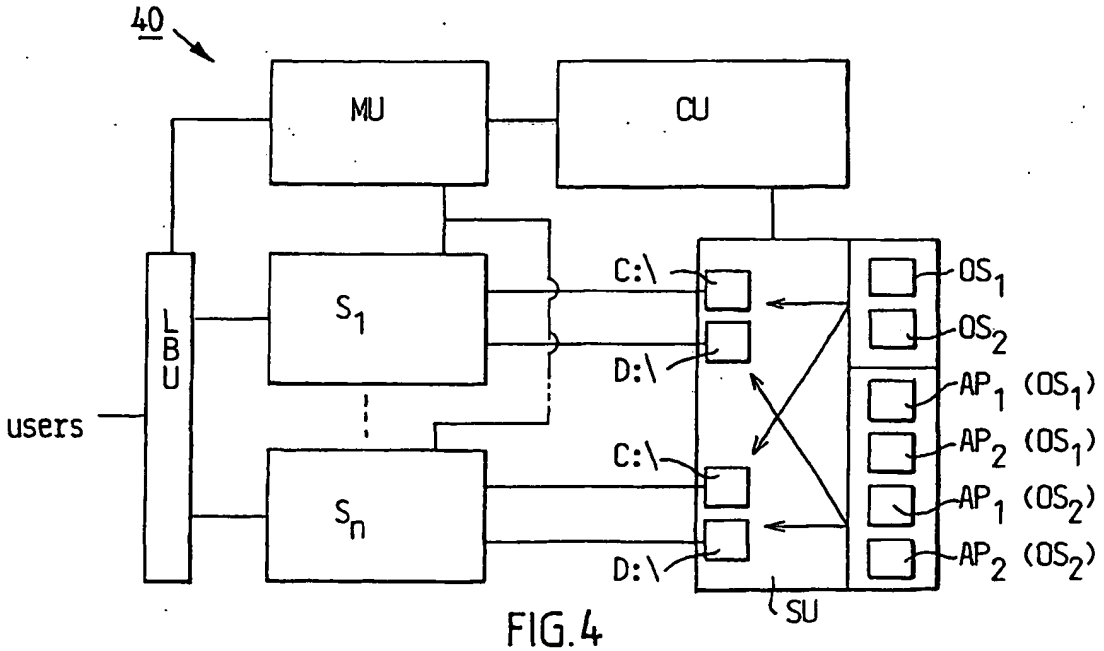
40
MU
CU
LBU
users
S_1
S_n
C:\
D:\
C:\
D:\
OS_1
OS_2
AP_1 (OS_1)
AP_2 (OS_1)
AP_1 (OS_2)
AP_2 (OS_2)
SU

FIG. 4

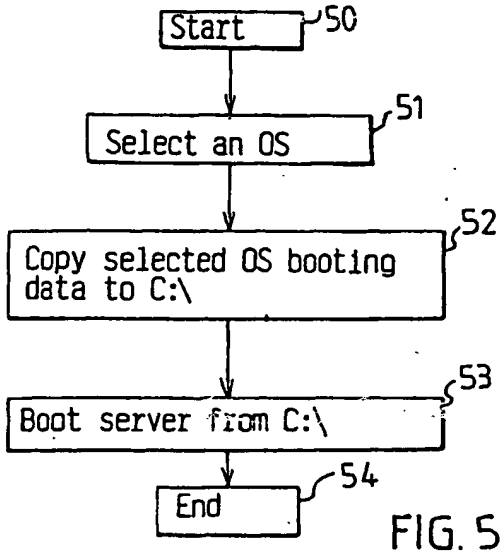
Start
50
Select an OS
51
Copy selected OS booting data to C:\
52
Boot server from C:\
53
End
54

FIG. 5

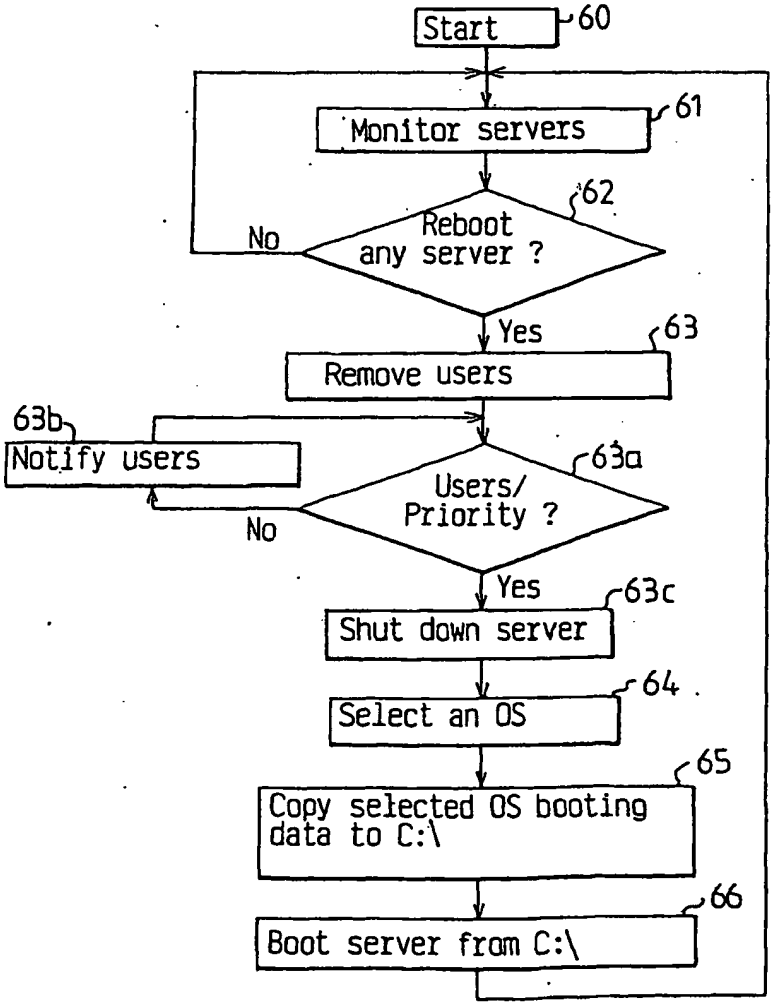
Start
60
Monitor servers
61
Reboot any server ?
62
No
Yes
Remove users
63
63b
Notify users
Users/ Priority ?
63a
No
Yes
Shut down server
63c
Select an OS
64
Copy selected OS booting data to C:\
65
Boot server from C:\
66

FIG. 6

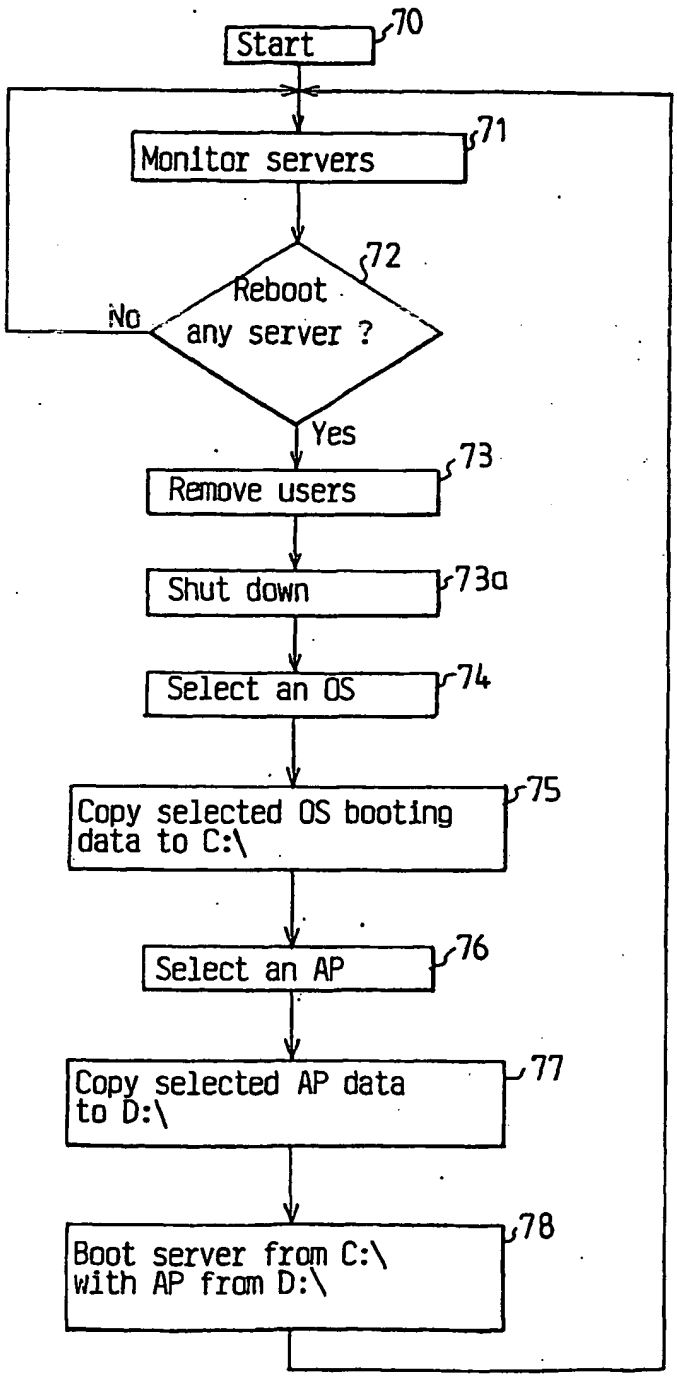
Start
70
Monitor servers
71
Reboot any server ?
72
No
Yes
Remove users
73
Shut down
73a
Select an OS
74
Copy selected OS booting data to C:\
75
Select an AP
76
Copy selected AP data to D:\
77
Boot server from C:\ with AP from D:\
78

FIG. 7

D4

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : H04M 3/64, 3/46, 3/36

A1

(11) International Publication Number: WO 94/09585

(43) International Publication Date: 28 April 1994 (28.04.94)

(21) International Application Number: PCT/US93/03307

(22) International Filing Date: 7 April 1993 (07.04.93)

(30) Priority data:
07/964,600 21 October 1992 (21.10.92) US

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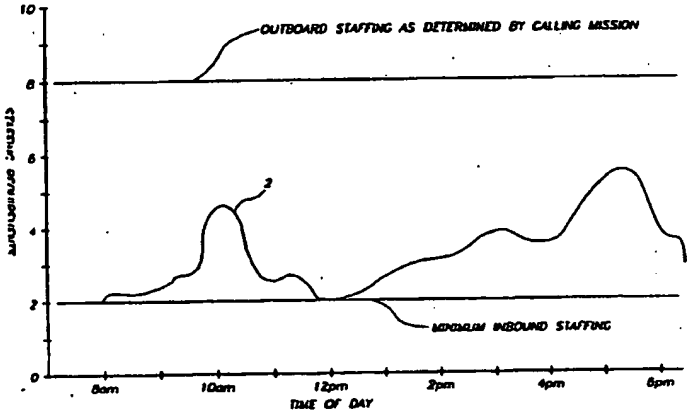
(81) Designated States: AU, CA, JP, NZ, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: INTEGRATED INTELLIGENT CALL BLENDING



(57) Abstract

A system and method for sharing a pool of agents (24, 26, 34) in a telephone call servicing operation so that agents are utilized effectively. The telephones of a pool of agents are coupled to a number of dedicated inbound communication lines (14) through an automatic call distributor (ACD) (18). The telephones of another pool of agents is coupled to a number of dedicated outbound communication lines (16) through an outbound dialer (30). The outbound agent telephones may be directly coupled to the outbound dialer, or may be coupled to the outbound dialer through the ACD. Alternatively, the agents may be in a single pool and all be available for servicing inbound and outbound calls. Agents are acquired from inbound call servicing to service outbound calls when the agent response indicator for inbound calls is below a predetermined threshold. Agents are acquired for outbound calling by placing an internal call from the outbound dialer through the ACD to an agent. An acquired agent is released by terminating the internal call, not the individual outbound calls handled by the acquired agent.

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Description

INTEGRATED INTELLIGENT CALL BLENDING

Technical Field

This invention relates generally to the field of automatic call distribution. More specifically, it relates to a method for controlling performance of a pool of personnel for optimum performance of both inbound and outbound call servicing.

Background of the Invention

Historically, large telephone service operations, such as customer service centers, separate inbound calling and outbound calling as separate operations. Each operation is governed by its own set of operational rules and objectives. Inbound calls are typically handled by an automatic call distributor (ACD). The goal of the inbound call servicing operation is to provide optimum response, which is usually defined as the speed of response to an arriving call by an operator or agent. This is measured by the average speed of answer (ASA). Other service quality definitions, such as abandonment rate, may be used. The abandonment rate indicates the number of customers who hang up while on hold.

The arrival rate of inbound call traffic is generally assumed to be a random process with a Poisson distribution based on the average arrival rate. The Poisson arrival process assumes that the arrival time of any one particular call is independent of the arrival time of any other call. From these statistics, a manual forecast of agent requirements is made based on the Erlang-C model. This is normally used in an inbound calling environment to schedule agents. Matching these agents' schedules to the random arrival rate of inbound calls is a source of inefficiency in the inbound call operation. If a large number of agents relative to the expected traffic is scheduled, the utilization of these agents will be low, although the quality of service to the caller will be high. If a small number of operators relative to the expected traffic is scheduled, the ASA will be poor, although the agent utilization will be high.

The arrival rate of inbound call traffic is further complicated by variations in traffic rate which are not addressed by the Erlang-C model. Such variations can be due to unexplained causes and consequently cannot be forecasted. This leads to large mismatches between actual traffic levels and staffing levels in spite of diligent efforts to match staffing with expected traffic levels. The mismatches between inbound call traffic and staffing cannot be completely eliminated by staff planning efforts. The result is

rampant chronic overstaffing, resulting in poor agent utilization, or understaffing, resulting in poor customer service in inbound calling operations.

Outbound calls are typically handled by an outbound dialer. Its goal is to maximize agent utilization by maximizing the number of valid telephone connections for a given population of agents and distribution of call characteristics. The connection rate of outbound traffic is controlled by the outbound dialer. Unlike the inbound call servicing operation, the outbound call servicing operation is not random. The connection rate can be adjusted to accommodate the pool of available agents. Because the inbound and outbound call servicing operations have different operational rules and objectives, they are treated as separate operations despite the inefficiency in agent utilization.

Therefore, it can be appreciated that a need exists to combine the pool of agents available to service inbound calls with the pool of agents available to service outbound calls so as to optimize agent efficiency while maintaining service quality in both inbound and outbound call servicing operations.

Summary of the Invention

A system and method of sharing a pool of agents coupled to a telephone exchange through a plurality of dedicated inbound communications and dedicated outbound communication lines. An automatic call distributor receives calls from the dedicated inbound communication lines and routes them to the telephones of available inbound agents in an agent pool. Other agents may be designated as outbound agents and have telephones which are coupled through an outbound dialer to the dedicated outbound communication lines. A third pool of agents may be designated to handle both inbound and outbound calls. The agents in the third pool may initially service inbound calls, but may be acquired to service outbound calls by having the outbound dialer place a call through the automatic call distributor to an agent in the third agent pool. When an agent in the third pool is so acquired, the agent may service a plurality of outbound telephone calls. The acquired agent continues to be coupled to the outbound dialer through the automatic call distributor as long as the acquired agent is servicing outbound calls. Acquired agents are released by terminating the acquisition call. When an acquired agent in the third agent pool is released, the agent returns to servicing inbound calls. Alternatively, agents may be acquired or released by sending commands to the automatic call distributor.

In an alternative embodiment, all agents are placed in a single agent pool, and agents are acquired by having the outbound dialer place an internal call through the automatic call distributor to the agent to be acquired. In another alternative

embodiment, agents may be acquired and released from different call operations. Agents may be acquired and released from alternative service tasks besides outbound call servicing.

Brief Description of the Drawings

Figure 1 is a graph illustrating an example of agent staffing requirements.

Figure 2 is a functional block diagram of a system incorporating the present invention.

Figure 3 is a flow chart illustrating the acquisition and release of agents using the present invention.

Figure 4 is a functional block diagram illustrating monitoring of call servicing operations using the present invention.

Figures 5A and 5B are functional block diagrams illustrating alternative embodiments of the present invention.

Figure 6A illustrates an agent acquisition procedure used with the present invention when using a typical ACD.

Figure 6B illustrates an agent acquisition procedure used with the present invention when using another type of ACD.

Detailed Description of the Invention

Prior art systems treat the inbound and outbound call servicing operations independently. To predict the number of operators or agents required for inbound call servicing, prior art systems use a call profile based on historical call volume data. For example, the call profile may indicate that 1,200 calls per hour is the average inbound call volume for a Monday, while there are only 750 calls per hour on a Tuesday. Supervisors manually examine the call profile and attempt to schedule the proper number of agents so that agent utilization is optimized and so that incoming calls are serviced satisfactorily. Agent scheduling is frequently done in fifteen-minute intervals, based on the call profile, in an attempt to schedule the proper number of agents.

In contrast, the present invention allows a pool of agents to be designated as inbound-only agents to service inbound calls. The number of inbound-only agents required may typically be determined by the minimum inbound call volume so that agent utilization or productivity is maximized. In the example of Figure 1, the actual inbound call volume shown by line 2 fluctuates throughout the day, but requires two inbound-only agents to service the minimum inbound call volume. The peak periods of inbound call volume require from four to six agents. The staffing requirements for the outbound calling mission is dependent on the particular mission. In

this example, the outbound calling mission requires eight outbound agents. In accordance with one aspect of the present invention, some of the outbound agents are used to service inbound calls during the periods of peak inbound call volume. Since two agents are designated as inbound-only agents, from two to four outbound agents are required during the peak periods to meet the staffing requirements of inbound call servicing. If the inbound call servicing is staffed with more than the minimum number of inbound-only agents, the agents will have decreased productivity during periods of low inbound call volume.

The present invention uses some outbound agents to meet the temporary staffing requirements of inbound call servicing. The agents that may be automatically switched between inbound and outbound call servicing are referred to as blend agents. In the present example, four of the eight outbound agents are designated as blend agents. The remaining agents are designated as outbound-only agents. Alternatively, more than four agents may be designated as blend agents. Thus, the present example shown in Figure 1 requires a total of ten agents, with two being designated as inbound-only agents, four or more as blend agents and the remaining agents being designated as outbound-only agents. It is clear that the staffing requirements shown in Figure 1 are examples only, and that the actual staffing requirements are dictated by the individual requirements of the call servicing operation.

By using blend agents with dynamic allocation between inbound and outbound operations, many of the problems of the prior art are solved. Overstaffing and understaffing can be eliminated by adapting quickly to the inbound traffic demands on the system. With sufficient blend agents there is no need to accurately forecast the call traffic as the present invention, via acquisition and release of blend agents, causes the calling operation to ride the traffic demand curve without a priori statistics on the curve. The current invention eliminates forecasting errors due to uncontrolled or unexplained factors and it also compensates for randomness. The system of the present invention adjusts to changes in call statistics as they happen over short time intervals. The inbound-only agent requirements may be determined by the minimum inbound call volume. The required number of blend agents may be determined by the peak inbound call volume. The number of outbound agents is determined by the specific outbound calling mission.

Typically, inbound calls will be transaction-oriented calls related to the primary application assigned to the agent pool. The arrival rate of these calls, although predictable over the long term, is random and highly variable in the short term. In contrast, the rate of outbound calling is highly predictable and can be altered, depending on such factors as the number of agents available to service outbound calls, the average

duration of a call, and time required by an agent to process data after termination of an outbound call. To assure a high-quality level of service for the inbound call servicing operation, prior art systems require a large pool of agents. During peak periods of inbound call volume, this large pool of agents is required to ensure that an agent will be available quickly to answer the inbound calls. The utilization of these agents, averaged over both the peak and non-peak periods, tends to be low. The present invention decreases overall staffing requirements and increases agent utilization by decreasing the number of inbound-only agents required and using blend agents to service inbound calls during periods of peak inbound call volume. Or, conversely, the present invention decreases overall staffing requirements and increases agent utilization by decreasing the number of outbound-only agents required and using blend agents to service outbound calls during lulls in inbound calling. The present invention increases overall call quality by using blend agents to service inbound calls during periods of peak inbound call volume and outbound calls during lulls in inbound calling. To effectively use blend agents, the present invention monitors all inbound and outbound calls to determine the status of all agents at all times.

As illustrated in Figure 2, the present invention is embodied in a system, referred to generally by reference numeral 10, which allows agents to be switched between inbound and outbound call servicing operations and from one call servicing operation to an unrelated call servicing operation or even to a related or non-related non-calling service operation so as to maximize agent utilization while simultaneously maintaining the quality of inbound call servicing. The system 10 can be configured to operate effectively with premises equipment or central office equipment. These terms, which are well known in the art, refer to equipment that is installed on the user's premises or installed in a central office and coupled to the user's premises via a communication link. For the purposes of this application, blend agents are "acquired" from servicing inbound telephone calls to service outbound telephone calls during non-peak periods of inbound call volume. As inbound call volume increases, an acquired agent is "released" to return to servicing inbound telephone calls. This terminology should not be considered a limitation, since it is clear that blend agents could initially be assigned to service outbound telephone calls and be acquired to service inbound telephone calls during periods of peak inbound call volume. In both situations, the system 10 maximizes productivity by sharing a pool of agents who handle inbound and outbound telephone calls. Because this invention relates to a telephone switching apparatus, it is apparent that the term "connecting an agent to a call" refers to connecting the agent's telephone device and not the agents themselves. Each agent in the system 10 may have one or more telephone devices.

As shown in Figure 2, the system 10 uses a telephone exchange 12. As used herein, a telephone exchange includes any network capable of routing calls, such as a Local Exchange Carrier (LEC), an Interchange Carrier (IXC), a Private Branch Exchange (PBX), a Centrex facility, or any public or private telephone network. In the present embodiment, the telephone exchange has a plurality of trunk lines. A number of the trunk lines are designated as dedicated inbound communication lines 14, and the remaining trunk lines are designated as dedicated outbound communication lines 16. As used herein, "dedicated inbound" means the communications lines are dedicated to receiving inbound telephone calls, and "dedicated outbound" means the communication lines are dedicated to outbound calling. The overall number of trunk lines required for a specific installation and the designation of trunk lines as dedicated inbound communication lines 14 and dedicated outbound communication lines 16 varies from one installation to another.

An automatic call distributor (ACD) 18 is coupled to the dedicated inbound communication lines 14 through a first distribution network connection 20 coupling the ACD to the dedicated inbound communication lines. The ACD typically uses the incoming directory number to identify the type of service required by the call. In other words, the ACD 18 knows the type of service required by the caller because of the telephone number of the particular communication line that the ACD answers. For example, the directory number 555-1234 may be a telephone number for billing inquiries, while the directory number 555-1235 may be a customer service number. The ACD 18 may use this directory number to select an agent from the appropriate agent pool provided for the particular service. The agent pool, sometimes known as a split, may subdivide the total agent pool into subgroups which may be allocated to different tasks, such as customer service, customer ordering, or the like. A large call service center may allocate different agent pools to service different clients.

The agents available to be acquired may be a part of an inbound agent pool 24 or may be allocated to a separate agent pool, which for the purposes of this application may be termed a blend agent pool 26. A blend agent is acquired from the blend agent pool 26 in a unique manner as described below.

The system 10 of Figure 2 places outbound telephone calls using an outbound dialer 30. The outbound dialer 30 has a first dialer network connection 32 coupling the outbound dialer to the dedicated outbound communication lines 16. When the outbound dialer 30 makes a successful connection to a customer, the particular communication line is coupled through the outbound dialer 30 to the telephone device (not shown) of an agent in an outbound agent pool 34 designated to service outbound calls. Because the dialing and successful connection rates for outbound dialers are both

controllable and predictable, the utilization of agents in the outbound agent pool 34 can be very high. Numerous algorithms in the prior art may be used to set the rate of outbound dialing by the outbound dialer 30. The system 10 adjusts the outbound dialing rate as blend agents are acquired to assist in servicing outbound calls or released to assist in servicing inbound calls.

In accordance with another aspect of the present invention, to place internal agent acquisition telephone calls to acquire a blend agent for outbound call servicing, the outbound dialer 30 has a second dialer network connection 36 coupling the outbound dialer to a second distributor network connection 38 of the ACD 18. A plurality of internal communications trunk lines 40 connect the second dialer network connection 36 with the second distributor network connection 38. When the utilization of agents servicing inbound calls is low, the outbound dialer 30 places a call through one of the internal communications trunk lines 40 to the ACD 18 through the second distributor network connection 38. The ACD 18 then directs the internal call to a desired blend agent from the blend agent pool 26. The ACD 18 couples the blend agent acquired from the blend agent pool 26 to the outbound dialer 30 through the ACD 18 and the internal communications trunk line 40. Under typical circumstances, an acquired blend agent from the blend agent pool 26 is used to service a plurality of outbound calls and only outbound calls during the period when the agent is acquired to service outbound calls. The internal communications trunk line 40 coupling the acquired blend agent through the ACD 18 to the outbound dialer 30 is maintained through these plurality of outbound calls.

Note that the term internal trunk lines 40 may refer to trunk lines that are physically located within the call servicing physical plant and directly couple the ACD 18 with the outbound dialer 30. However, the present invention is not limited only to call servicing operation in which the agents are physically located within a single facility. Nor is the term "internal trunk lines" limited only to communications lines within a single facility. The means for implementing the telephone connection could be any commonly available telephone circuit provided by a private or public network. The term internal trunk lines refers to communications lines that are used within the system 10 to acquire or release an agent. As indicated by the dashed line, the internal trunk lines 40' may be part of the telephone exchange 12. This arrangement allows an agent to be coupled to the system 10 anywhere in the world where there is a telephone exchange 12. For example, an agent may be part of a call servicing operation in one location, such as the agent's home, and coupled to the system 10 in a separate location through the telephone exchange 12. The agent operating at home may be part of the inbound call servicing and is coupled to the system 10 through the ACD 18. The agent at home may be acquired

for outbound call servicing by having the system 10 place an internal agent acquisition call through the internal trunk lines 40' to couple the agent at home to the outbound dialer 30 to service outbound calls. The internal trunk lines 40' may be coupled to the telephone exchange 12 through the network connections 36 and 38, or may be coupled to the telephone exchange 12 through the network connections 32 and 20, and the dedicated outbound communications lines 16 and the dedicated inbound communications lines 14.

Alternatively, the ACD 18 of some manufacturers allow the acquisition and release of an agent through the use of commands to the ACD 18. For example, the AT&T model DEFINITY GENERIC 3 ACD allows the system 10 to log agents off of inbound call servicing and log on to outbound call servicing without the need for agent acquisition calls. These acquisition and release commands are sent to the ACD 18 by the analyzer 42, based on the determinations described in detail below. Thus, the present invention can be used with ACDs 18 requiring the acquisition and release of agent by placing acquisition calls, and with ACDs 18 requiring acquisition and release commands sent directly to the ACD to acquire and release an agent.

In one embodiment of the invention, if the utilization of agents from the inbound agent pool 24, and the blend agent pool 26 for blend agents that are still servicing inbound calls, becomes high and the ASA increases beyond a predetermined upper threshold speed, the acquired blend agent may be returned to servicing inbound calls by terminating the internal communication link between the ACD 18 and the outbound dialer 30. In other words, the internal call is terminated. It should be obvious to one skilled in the art that other performance criteria could just as easily be used. Upon termination of the internal communication link, the acquired blend agent is released and is available to service inbound calls. As blend agents are acquired and released, the outbound dialer 30 adjusts the rate of outbound dialing to compensate for the fluctuation in the number of agents in the blend agent pool 26 and the outbound agent pool 34 available for outbound call servicing.

An analyzer 42 is used to monitor inbound calls and outbound calls and compile a set of statistics related to both inbound and outbound calls. The set of statistics, which are used to determine the level of service quality for both inbound and outbound call servicing, as well as the performance and utilization of agents, will be discussed in detail below. The analyzer 42 determines whether an agent should be acquired or released. The analyzer also causes the outbound dialer 30 to adjust the rate of outbound dialing depending on the number of agents available to service outbound calls. The analyzer 42 may be part of the ACD 18, the outbound dialer 30 or may be an independent unit. The status of agents in the various agent pools 24, 26 and 34 may be

monitored through a conventional device known as a switch to computer application interface (SCAI) 44, which may also be called a Computer-Telephone Integration (CTI) link. The SCAI 44 continuously monitors the status of all incoming calls, outbound calls, and the status of agents in the various agent pools 24, 26, and 34. As should be obvious to one skilled in the art, other means may be used for monitoring inbound and outbound calls to gather information for processing in the analyzer, such as Call management System, a standard feature of most ACDs.

The analyzer 42 executes the algorithm shown in Figure 3. In decision block 60, the analyzer determines whether any call has changed states. The change in state includes events such as call abandonment, the connection of a waiting call to an available agent, or the termination of a call following servicing by an agent. If there has been no change in the call state, the result of decision block 60 is "NO" and the program loops until there is a change in call state. If there is a change in call state, the result of decision block 60 is "YES" and decision block 62 checks to determine whether there is a sufficient agent capacity to service the inbound call volume. If there is sufficient agent capacity, the result of decision block 62 is "YES". The analyzer 42 then checks in decision block 64 to determine whether there is excess agent capacity servicing inbound calls. The criteria used to determine whether there is sufficient or excess agent capacity are discussed below. If there is not excess agent capacity servicing inbound calls, the result of decision block 64 is "NO" and the program loops back to decision block 60. If the system determines that there is excess agent capacity servicing inbound calls, the result of decision block 64 is "YES" and the system 10 acquires a blend agent in block 66. The acquired agent is transferred from servicing inbound calls to servicing outbound calls. Following the acquisition of a blend agent, control of the program is returned to decision block 60.

If there is not sufficient agent capacity servicing inbound calls, the result of decision block 62 is "NO." In that event, the system 10 releases an acquired agent in block 68. As described above, an acquired agent is released by terminating the communications link on the internal communications trunk line 40 between the outbound dialer 30 and the ACD 18 (see Figure 2). The released agent is transferred from servicing outbound calls to servicing inbound calls.

As previously stated, the decision whether to acquire an agent or release an agent is made based on the desired level of service quality for a particular call servicing operation and/or the desired agent performance. Many measures of the level of service quality may be used satisfactorily with the present invention. The abandonment rate and the ASA are frequently used. Agent utilization (the amount of time spent on call related work relative to the total time available) is a common

performance measure. The measure of the level of service quality, whether it is the ASA, abandonment rate, some additional factor, or a combination of factors, may be referred to as a "response indicator." The system 10 may also be programmed to provide response indicators for different types of call servicing operations. In the previous example, where different directory numbers identify the type of service required by an inbound call, the user may determine that customer service calls require a higher level of service quality than customer billing inquiry calls. Accordingly, the response indicators may be independently adjusted for the customer service calls and for customer billing inquiry calls. If the response indicator for any type of call service is below a predetermined value for that call service and agent utilization is below a predetermined value, an agent may be acquired from that inbound call servicing operation to service outbound calls in a related outbound call servicing operation. Alternatively, the acquired agent may be used to service inbound or outbound calls from an unrelated call servicing operation or to perform some other activity, as will be discussed below. The analyzer 42 determines the response indicator using the compiled statistics.

The analyzer 42, using the SCAI 44 or other monitoring means, may determine a variety of statistics for both inbound and outbound calls as shown in Figure 4. The analyzer 42 monitors the traffic rate 100, that is, the rate of inbound and outbound calls. The traffic rate is the average arrival rate for inbound calls offered to the system 10. In addition, the analyzer 42 monitors the talk time 102, which is the amount of time that an agent is actually on the communications line servicing a call. Following completion of a call, an agent may be required to perform additional tasks to complete the servicing of the call, sometimes called the wrap-up time 104. Agent wrap-up time is the amount of time an agent spends working on the call, from the end of the agent's talk portion of the call until the agent is ready for another call. This may include completion of information for a customer order, a billing request, arrangements for payment of a bill, or the like. The agent work time is determined as the sum of the agent talk time 102 and the agent wrap-up time 104. The status of all agents in the agent pool is also monitored by the analyzer 42. For example, the analyzer 42 monitors when agents take a break and are unavailable for call servicing. The analyzer monitors the status of in-service agents 106 and out-of-service agents 108 as well as idle agents 109, who are available to service calls, but are not currently servicing a call. This may be done using an agent table 110, which lists the current status of each agent. The analyzer 42 must also keep track of the agents acquired 112 or released 114 by the process described above. It is obvious to those of ordinary skill in the art that other statistics may be used to monitor the status of agents and the performance of agents. The

statistics relating to inbound calls may be used to estimate the number of agents required to service incoming calls while maintaining the measure of the level of service quality at a predetermined value.

These statistics may be directly derived from the ACD 18 or may be computed indirectly depending on the type of ACD 18 coupled to the system 10. An ACD 18 typically provides some status messages to the analyzer 42. The normal status messages include connect and disconnect messages indicating when a particular agent has been connected to an inbound telephone call and when the inbound call has terminated. Other statistics must be derived, inferred or imputed from the typical ACD 18 status messages. For example, if a particular agent is coupled to an inbound call, the analyzer 42 receives a status message from the ACD 18. When the inbound call is terminated, the analyzer 42 is informed of the termination by a status message from the ACD 18. The average agent wrap-up time or other statistic based on wrap-up time can be updated directly if the next call given to the agent by the ACD was previously queued. If the next call was queued it means that all agents were busy servicing calls and there was no opportunity for idle time by this agent between calls. Thus, the wrap-up time is the measured wrap-up time whenever possible. If the next call given the agent was not previously queued then there is a high probability that this agent was not busy and that there was some idle time between the end of the agent wrap-up time 104 for the previous call and the connection of this next call. In this case the agent wrap-up time 104 is estimated or imputed to be some fraction (always less than one) of the average wrap-up time. Estimating the contribution to the average as a fraction less than one tends to increase the probability that an agent will be acquired for outbound calling. In the long run this will tend to lower the number of available agents servicing inbound calls and will eventually force calls to be queued, resulting in more accurate estimates of agent wrap-up time. Thus, as long as the fractional estimate of the average wrap-up time is less than one, the system will be forced to an equilibrium state where the correct wrap-up time statistic is available. If a particular agent is not coupled to another inbound telephone call for a period of time exceeding the average wrap-up time as calculated by the analyzer 42, the analyzer may infer that the agent status has changed from wrap-up to idle. The analyzer 42 may alter the agent table 110 accordingly. The number of agents in service is the number of agents who are truly working on calls or idle and waiting for a call. This may differ from the number logged on. The number of agents available may be determined from call connect events. When the ACD connects a call to a particular agent that agent is marked as being in service. When an agent stays in the work state (either talk or wrap-up) for an inordinate amount of time the agent is marked as not being in service. The definition of "inordinate" is system dependent, but

is related to the average work time. Since the ACD normally assigns calls to available agents on a rotating basis ("first available" or "most idle") the available agents will quickly be detected because they are the ones to whom calls will be connected. As in the case of estimating agent wrap-up time, the estimate that an agent is available tends to increase the probability that an agent will be acquired for outbound calling. In the long run this will tend to lower the number of available agents servicing inbound calls and will eventually force calls to be queued, resulting in a more accurate estimate of agent available agents as well as of agent wrap-up time. Thus the system will be forced to an equilibrium state where the correct statistics are available. Thus, the analyzer 42 can indirectly compute statistics from the limited status messages provided by the ACD 18.

Other types of ACDs 18 provide additional status messages that allow direct determination of the statistics. For example, ACDs such as the AT&T model 5ESS provide status messages to indicate agent log-in and log-out, so that the analyzer 42 knows if the agent is in-service 106 or out-of-service 108. This allows the system 10 to directly determine the number of agents currently working on the system 10 in both inbound call servicing or outbound call servicing. Similarly, the model 5ESS provides a status message when an agent has completed the after call servicing and is available to service additional inbound calls. This status message allows the direct computation of agent wrap-up time 104. The system 10 is designed to operate effectively with ACDs providing more complete status messages or those ACDs which provide only limited status messages.

These statistics may be compiled to predict the inbound call volume. The analyzer 42 may use the compiled statistics to determine the number of agents required to service inbound calls so that the response time is below the predetermined value and/or the performance is above the predetermined value. The analyzer 42 will release any acquired agents in anticipation of an increase of inbound call volume as predicted by the compiled statistics. Similarly, the analyzer may acquire agents for outbound call servicing if the compiled statistics predict that the inbound call volume is decreasing.

Prior art systems use a historical call profile to manually schedule staffing requirements. Prior art systems do not use blend agents to meet the demands of peak inbound call volume. In contrast, the present invention compiles call statistics to dynamically predict peak inbound call volumes. Blend agents are used to meet the demands of peak inbound call volume, thus simplifying the agent scheduling procedure. Furthermore, the inventive system 10 acquires and releases agents in a unique manner using compiled call statistics to predict agent staffing requirements.

The present invention is designed to simultaneously optimize the level of service quality and agent utilization. The various measures of service quality are discussed above. The agent utilization, which may also be called agent productivity, can also be measured by the analyzer 42. For purposes of the present invention, agent productivity may be defined as the ratio of inbound call traffic rate to the product of inbound call service rate and the number of agents available for servicing inbound call traffic when the ratio is less than one. If the ratio is greater than one, the agent productivity is one, which indicates that the agent is always busy servicing inbound calls. The inbound call service rate is defined as the reciprocal of the amount of time required to service inbound calls, including talk time 102 and wrap-up time 104. The number of agents available for servicing inbound calls includes both agents who are currently busy servicing an inbound call and agents who are currently idle but are available to service an inbound call. The ratio gives an estimate of the percentage of agent capacity over a period of time. For example, a ratio of one indicates that the capacity to service calls exactly matches the demand for service. A ratio of .5 indicates that the demand for call servicing is one half the capacity for servicing the demand (*i.e.*, the agents are busy one half of the time).

As described above, some call servicing operations assign different measures of the level of service quality to different aspects of the call servicing operation. Similarly, different aspects of the call servicing operations may desire different levels of agent productivity. If agents are operating at 100% efficiency, there may be job dissatisfaction and a high turnover rate. On the other hand, low productivity is not cost effective, and may lead to job boredom. Therefore, the present invention allows call servicing operations to select the level of agent productivity best suited for their needs. Furthermore, the present invention allows a call servicing operation to independently select a predetermined level of productivity and measure of the level of service quality. The system 10 strives to simultaneously optimize both of these criteria. For example, a particular call servicing operation may determine that 90% agent productivity allows the agents to have some idle time between servicing inbound calls, while at the same time preventing job boredom. The call servicing operation may also determine that a high level of service quality must be maintained because of the nature of the inbound calls. For example, inbound calls must be coupled to an agent in less than 20 seconds because the call servicing operation is a customer ordering operation. The system 10 acquires agents for outbound call servicing if the measured agent productivity is less than 90%, and all inbound calls are being serviced in less than 20 seconds. Agent acquisition may be controlled by either agent productivity, the measured level of service quality, or both. The system 10 releases agents if the inbound calls are not being

serviced in less than 20 seconds. Alternatively, the system 10 may release agents if the productivity of the remaining inbound agents exceeds the 90% goal.

The system 10 may also be designed to allow temporary changes in agent productivity above the predetermined goal. For example, a transient increase in incoming call rate may cause the agent productivity to be 100%, but only for a short period of time. The system 10 may be designed to allow such short fluctuations for a predetermined period of time. Note that if the agent productivity is 100%, the measure of the level of service quality may also be affected. For example, if the agents servicing inbound calls are busy 100% of the time, some inbound calls may be waiting for more than 20 seconds. In that case, the system 10 may release an acquired agent in order to meet the predetermined goal for the measure of service quality. Thus, the system 10 may be used to optimize both agent productivity and service quality, or may optimize one criterion at the expense of the other.

The present invention may be used with automatic call distributors manufactured by a variety of companies. The ACD 18 is programmed to select from the agent pool an agent who has been defined as being from the agent pool appropriate for servicing the application defined by the directory number. A variety of agent pool configurations may be used satisfactorily with the inventive system 10. For example, the inbound agent pool 24 and the blend agent pool 26 may initially be placed in separate agent pools and coupled to the ACD 18 with the outbound agent pool 34 coupled directly to the outbound dialer 30 as illustrated in Figure 2. However, all agents may initially be placed in a single agent pool 25 coupled to the ACD 18, as shown in Figure 5A. The agent pool 25 may be broken down into separate agent pools 22, 24, and 34 as shown in Figure 5B. Agents may be acquired to service outbound telephone calls by placing internal agent acquisition calls as previously described. Alternatively, all agents could initially be placed in a single agent pool or multiple agent pools coupled directly to the outbound dialer 30, and released in the manner described above to service inbound telephone calls. As previously noted, the internal communications trunk line 40' may be part of the telephone exchange 12 or may be separate internal communications trunk lines 40 physically coupling the ACD 18 to the outbound dialer 30.

The different agent pool configurations correspond to different internal configurations of the ACD 18. As an example of the use of agent pools, consider the illustration of Figure 6A, in which the ACD 18 contains two inbound queues, number one queue 82 and number two queue 86, which hold incoming calls received by the ACD. In this internal ACD configuration, the agents in the inbound agent pool 24 are assigned to number one queue 82 and are designated as inbound-only agents. Inbound-only agents are never acquired for outbound call servicing. The number two queue 86 is

used by the present invention to acquire blend agents from a blend agent pool 26. The ACD 18 will receive inbound calls from the telephone exchange 12 and direct them to the inbound-only agents in the inbound agent pool 26 before directing any inbound calls to blend agents in the blend agent pool 26. The ACD 18 will direct calls to blend agents only during periods of peak inbound call volume if all of the inbound-only agents in the inbound agent pool 24 are occupied.

During non-peak periods, the inbound call volume is low enough that blend agents from the blend agent pool 26 are not required for inbound call servicing. The blend agent may be acquired from the blend agent pool 26 by having the system 10 place an internal telephone call through the number two queue 86 to acquire one or more of the blend agents. Note that the ACD 18 will never direct a call through the number two queue 86 to an inbound-only agent in the inbound agent pool 24. Thus, the inbound calls from the telephone exchange 12 are directed first to the inbound-only agents in the inbound agent pool 24, with the peak inbound call volume these inbound-only agents cannot handle being directed to the blend agents in the blend agent pool 26. When the inbound call volume from the telephone exchange is low, the calls in number one queue 82 are directed only to the inbound-only agents in the inbound agent pool 24. This allows blend agents in the blend agent pool 26 to be acquired by the system 10 for outbound call servicing. The blend agents are acquired by placing a call to the number two queue 86, which the ACD 18 directs only to the blend agents in the blend agent pool 26.

In a different internal ACD configuration, shown in Figure 6B, there are two inbound queues, number one queue 90 and number two queue 96, which operate in the manner described above for inbound number one and two queues 82 and 86. However, the ACD 18 uses a single agent pool 25 in which agents are designated as inbound-only agents 94 or blend agents 98. As with the previous ACD configuration, the ACD 18 will initially direct inbound calls only to the agents designated as inbound-only agents 94 in the agent pool 25. Only during periods of peak inbound call volume, when all inbound-only agents 94 are busy, will the ACD 18 direct some of the peak inbound call volume to agents designated as blend agents 98. In the non-peak periods, the system 10 will place agent acquisition calls through the ACD 18 to inbound number two queue 96. These calls are directed only to the blend agents 98 in the agent pool 25.

The present invention may operate satisfactorily with a number of agent access modes available in a typical ACD. A common mode is the first in first out mode in which calls in an inbound queue are processed in the order in which they are received. Thus, the call that is waiting the longest will be the first call serviced. The ACD 18 may be programmed for a priority mode in which a special customer, for example, will

receive priority service by calling a special number. These priority calls are processed ahead of other calls that may be waiting in the inbound queue. Other modes, well known to those in the art, are also available.

As discussed above, there are many possible alternative embodiments of the inventive system 10 for use with a variety of internal configurations of the ACD 18. In the example illustrated in Figure 5A, a single agent pool 25 is coupled to the ACD 18. In this manner, all agents in the agent pool 25 may be designated as blend agents. Alternatively, a minimum number of agents may be designated to service outbound calls only or a minimum number of agents designated to service inbound calls only, or both. Blend agents may be acquired to service outbound calls in the manner previously described. Agents who are designated as inbound agents only, or blend agents who are currently servicing inbound calls, are coupled to the dedicated inbound communication lines 14 through the ACD 18, as previously described.

Agents who are designated to service outbound calls only, or acquired blend agents, are coupled to the dedicated outbound communication lines 16 through the ACD 18 and the outbound dialer 30, as previously described. The process of acquiring a blend agent and releasing an acquired agent occurs in the same inventive method previously described.

Some call servicing operations have additional needs beyond inbound and outbound call servicing. For example, a typical call servicing operation may have need of word processing services. Other call servicing operations may have a small outbound call mission, or no outbound call mission at all. The principles of the present invention may be applied to call servicing operations in which acquired agents perform alternative services besides outbound call servicing. These alternative services may include word processing, filing, or other clerical or managerial duties, or the like. The agents are acquired and released in the manner described above.

In some call servicing operations, the agent pools may be assigned to different call operations. For example, a first pool of agents may be assigned to a first client and will service the first client's inbound and outbound calls in the manner described above. The agents assigned to the first client may be in separate agent pools 24, 26, and 34 as shown in Figure 2, or may be in a single agent pool 25, as shown in Figure 5A. The agents servicing the first client may be acquired or released, as described above, as inbound call volume to the first client fluctuates. A second group of agents may be assigned to a second client to service the second client's inbound and outbound calls. Similarly, the agents assigned to the second client may be in separate agent pools 24, 26, and 34 as shown in Figure 2, or may be in a single agent pool 25, as shown in Figure 5A. It should be noted that the agent pool or pools for client number

one are not the same as the agent pool or pools for client number two. The principles of the present invention may be independently applied to the different call operations. Furthermore, the present invention allows agents assigned to one client to be acquired by another client if the analyzer 42 determines that the acquisition will not cause the response indicator to exceed the predetermined period of time for the call operation from which the agent will be acquired. Because the analyzer 42 determines the status of all agents, the quality level of service for all inbound and outbound call operations may be maintained.

Some prior art call servicing systems have a large pool of agents which may be designated as inbound agents, outbound agents, or both. However, these prior art systems do not use a fixed number of inbound communication lines and outbound communication lines. As the inbound call volume increases, the prior art systems switch trunk lines from outbound communication lines to inbound communication lines. It should be noted that this prior art system does not switch agents. Agents using the prior art system are assigned to a single pool and perform both inbound and outbound call servicing.

A drawback of the prior art system is that peak inbound call volume may cause all available agents to service inbound calls which allows the outbound call rate to drop to zero even though there may be a number of outbound communication lines available. If the prior art system switches too many outbound communication lines to inbound communication lines, there may be an insufficient number of outbound communication lines. This may effectively reduce the outbound calling rate even if there is sufficient agent capacity to maintain an outbound call servicing operation.

Another drawback to the prior art approach of switching trunk lines between being inbound communication lines and being outbound communication lines is the occurrence of glare. Glare is a term of art used to describe a condition in which a communication line is seized by an outbound dialer to make an outbound telephone call at the same moment that the communication line receives an inbound telephone call. The result is that the inbound caller experiences a loud unpleasant noise due to the competition for the same line between the inbound and outbound telephone calls.

In contrast, the system 10 of the present invention uses a set number of dedicated inbound communication lines 14 and dedicated outbound communication lines 16 and does not switch communication lines from inbound call servicing to outbound call servicing during the performance of a calling mission. It is possible that changes in a customer's call service operations may require a change in the number of dedicated inbound communication lines 14 and dedicated outbound communication lines 16. The inventive system 10 allows such a reconfiguration, but does not switch communication

lines during the call servicing operation. In this manner, glare is eliminated since there will never be competition for the same communication line between inbound and outbound call servicing. Instead of switching trunk lines to accommodate fluctuations in inbound call volume, the system 10 of the present invention switches the agents between inbound and outbound call servicing. The system 10 allows the user to specify a minimum number of agents for the outbound agent pool 34. In this manner, it is possible to maintain a minimum rate of outbound telephone calls, despite an increase in inbound call volume.

Those skilled in the art will appreciate that the novel approach to call servicing taken by the present invention provides for maximum utilization of agents, for both inbound and outbound call servicing. The acquisition of blend agents through the ACD 18 allows the analyzer 42 to monitor agent status and maintain minimum quality standards for both inbound and outbound call servicing. The use of dedicated inbound communication lines 14 and dedicated outbound communication lines 16 avoids the problem of glare and assures that outbound call servicing always has communication lines available for use.

It should be noted that some examples presented herein depict a single agent pool coupled to the ACD 18. The agents are transferred to outbound call servicing through the ACD 18, as described above. It is clear that the same inventive approach may be used to transfer agents from a pool of agents coupled to the outbound dialer 30 instead of the ACD 18. The agents are transferred to inbound call servicing through the outbound dialer 30 and the ACD 18.

It is to be understood that even though various embodiments and advantages of the present invention have been set forth in the foregoing description, the above disclosure is illustrative only, and changes may be made in detail, yet remain within the broad principles of the present invention. Therefore, the present invention is to be limited only by the appended claims.

Claims

1. A system for simultaneously maximizing productivity and call servicing quality by sharing a pool of agents handling inbound and outbound telephone calls, each agent having a telephone device, the system comprising:

a telephone exchange having a plurality of trunk lines designated as dedicated inbound communication lines and a plurality of trunk lines designated as dedicated outbound communication lines;

an automatic call distributor to couple the inbound telephone calls to the telephone devices of a plurality of agents from the pool of agents designated as inbound agents, said automatic call distributor having first and second distributor network connection, said first distributor network connection coupling said automatic call distributor to said dedicated inbound communication lines to receive inbound telephone calls from said telephone exchange;

an outbound dialer to automatically place outbound telephone calls for one or more agents from the pool of agents designated as outbound agents, said outbound dialer being coupled to the telephone devices of said outbound agents, said outbound dialer having first and second dialer network connections, said first dialer network connection coupling said outbound dialer to said dedicated outbound communication lines to place outbound telephone calls to said telephone exchange, said second dialer network connection coupling said outbound dialer to said second distributor network connection of said automatic call distributor through a plurality of internal trunk lines to place internal agent acquisition telephone calls;

an analyzer to analyze the inbound telephone calls, to determine a response indicator indicative of a level of service quality, and to determine agent productivity;

acquisition means for acquiring one of said inbound agents to service one or more outbound telephone calls using said outbound dialer if said response indicator indicates that said level of service quality exceeds a predetermined service quality goal and said productivity is less than a predetermined productivity goal, said acquisition means using said outbound dialer to place an internal telephone call to said acquired agent through one of said plurality of internal trunk lines and said automatic call distributor; and

releasing means for releasing said acquired inbound agent if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said releasing means terminating said internal telephone call to said acquired inbound agent through said one internal trunk line so that said acquired inbound agent may resume servicing inbound telephone calls, whereby said acquired inbound agent is selectively

acquired for and released from outbound telephone call servicing by establishing and terminating an internal telephone call using said outbound dialer, said one internal trunk line and said automatic call distributor.

2. The system of claim 1 wherein said analyzer compiles a set of statistics relating to the inbound telephone calls and uses said compiled statistics to measure said level of service quality.

3. The system of claim 2 wherein said compiled statistics includes the rate of incoming calls, the duration of incoming calls, the number of said inbound agents available to service inbound telephone calls, current status of said inbound agents, and the time required by said inbound agents to process data after termination of inbound calls.

4. The system of claim 3 wherein said analyzer uses said compiled statistics to estimate the number of said inbound agents required to service inbound telephone calls and achieve said predetermined service quality goal.

5. The system of claim 1, further including a switch to computer interface coupled to said automatic call distributor and said outbound dialer to monitor the status of said dedicated inbound communication lines, said dedicated outbound communication lines, said plurality of internal trunk lines, and the status of said inbound and outbound agents.

6. The system of claim 1 wherein said outbound dialer is a predictive outbound dialer, said outbound dialer automatically changing the rate of outbound telephone calls as said acquired agent is acquired or released.

7. A system for simultaneously maximizing productivity and call servicing quality by sharing a pool of agents handling inbound and outbound telephone calls on a telephone exchange having a plurality of trunk lines designated as dedicated inbound communication lines and a plurality of trunk lines designated as dedicated outbound communication lines, each agent having a telephone device, the system comprising:

an automatic call distributor to couple the inbound telephone calls to the telephone devices of a plurality of agents from the pool of agents designated as inbound agents, said automatic call distributor being coupled to the dedicated inbound communication lines to receive inbound telephone calls from the telephone exchange;

an outbound dialer to automatically place outbound telephone calls for a plurality of agents from the pool of agents designated as outbound agents, said outbound

dialer being coupled to the telephone devices of said plurality of outbound agents to place outbound telephone calls onto the telephone exchange, said outbound dialer also being coupled to said automatic call distributor through a plurality of internal trunk lines to place internal agent acquisition telephone calls;

an analyzer to analyze inbound telephone calls, compile a set of statistics relating to inbound telephone calls, to determine a response indicator indicative of a level of service quality, and to determine agent productivity;

acquisition means for acquiring one of said inbound agents to service one or more outbound telephone calls using said outbound dialer if said response indicator indicates that said level of service quality exceeds a predetermined service quality goal and said productivity is less than a predetermined productivity goal, said acquisition means using said outbound dialer to place an internal telephone call to said acquired agent through one of said plurality of internal trunk lines and said automatic call distributor; and

releasing means for releasing said acquired inbound agent if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said releasing means terminating said internal telephone call to said acquired inbound agent through said one internal trunk line so that said acquired inbound agent may resume servicing inbound telephone calls, whereby said acquired inbound agent is selectively acquired for and released from outbound telephone call servicing by establishing and terminating an internal telephone call using said outbound dialer, said one internal trunk line and said automatic call distributor.

8. The system of claim 7, further including a switch to computer interface coupled to said automatic call distributor and said outbound dialer to monitor the status of said dedicated inbound communication lines, said dedicated outbound communication lines, said plurality of internal trunk lines, and the status of said inbound and outbound agents.

9. The system of claim 7 wherein said automatic call distributor initially couples inbound telephone calls to the telephone devices of a plurality of inbound agents designated as inbound only agents until all of said inbound only agents are servicing inbound telephone calls before coupling any inbound telephone calls to the telephone devices of a plurality of agents designated as inbound or outbound agents.

10. A system for simultaneously maximizing productivity and call servicing quality by sharing a pool of agents handling inbound and outbound telephone calls on a telephone exchange having a plurality of trunk lines designated as dedicated inbound

communication lines and a plurality of trunk lines designated as dedicated outbound communication lines, each agent having a telephone device, the system comprising:

an automatic call distributor to couple the inbound telephone calls to the telephone devices of a plurality of agents from the pool of agents designated as inbound agents, said automatic call distributor being coupled to the dedicated inbound communication lines to receive inbound telephone calls from the telephone exchange;

an outbound dialer to automatically place outbound telephone calls for a plurality of agents from the pool of agents designated as outbound agents, said outbound dialer being coupled to the telephone devices of said plurality of outbound agents to place outbound telephone calls onto the telephone exchange;

an analyzer to analyze inbound telephone calls, to determine a response indicator indicative of a level of service quality, and to determine agent productivity;

acquisition means for acquiring one of said inbound agents to service one or more outbound telephone calls using said outbound dialer if said response indicator indicates that said level of service quality exceeds a predetermined service quality goal and said productivity is less than a predetermined productivity goal, said acquisition means using said outbound dialer to place an acquisition telephone call to said acquired agent through said automatic call distributor; and

releasing means for releasing said acquired inbound agent if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said releasing means terminating said acquisition telephone call to said acquired inbound agent through said automatic call distributor so that said acquired inbound agent may resume servicing inbound telephone calls, whereby said acquired inbound agent is selectively acquired for and released from outbound telephone call servicing by establishing and terminating a telephone call using said outbound dialer and said automatic call distributor.

11. The system of claim 10 wherein said analyzer compiles a set of statistics relating to the inbound telephone calls and uses said compiled statistics to measure said level of service quality.

12. The system of claim 11 wherein said compiled statistics includes the rate of incoming calls, the duration of incoming calls, the number of said inbound agents available to service inbound telephone calls, current status of said inbound agents, and the time required by said inbound agents to process data after termination of inbound calls.

13. The system of claim 12 wherein said analyzer uses said compiled statistics to estimate the number of said inbound agents required to service inbound telephone calls and achieve said predetermined service quality goal.

14. The system of claim 10, further including a switch to computer interface coupled to said automatic call distributor and said outbound dialer to monitor the status of the dedicated inbound communication lines, the dedicated outbound communication lines, and the status of said inbound and outbound agents.

15. The system of claim 10 wherein said automatic call distributor initially couples inbound telephone calls to the telephone devices of a plurality of inbound agents designated as inbound only agents until all of said inbound only agents are servicing inbound telephone calls before coupling any inbound telephone calls to the telephone devices of a plurality of agents designated as inbound or outbound agents.

16. A system for simultaneously maximizing productivity and call servicing quality by sharing a pool of agents handling inbound and outbound telephone calls on a telephone exchange having a plurality of trunk lines designated as dedicated inbound communication lines and a plurality of trunk lines designated as dedicated outbound communication lines, each agent having a telephone device, the system comprising:

an automatic call distributor to couple the inbound telephone calls to the telephone devices of a plurality of agents from the pool of agents designated as inbound agents, said automatic call distributor being coupled to the dedicated inbound communication lines to receive inbound telephone calls from the telephone exchange;

an outbound dialer to automatically place outbound telephone calls for a plurality of agents from the pool of agents designated as outbound agents, said outbound dialer being coupled to the telephone devices of said plurality of outbound agents to place outbound telephone calls onto the telephone exchange;

an analyzer to analyze inbound telephone calls, to determine a response indicator indicative of a level of service quality, and to determine agent productivity;

acquisition means for acquiring one of said inbound agents to service one or more outbound telephone calls using said outbound dialer if said response indicator indicates that said level of service quality exceeds a predetermined service quality goal and said productivity is less than a predetermined productivity goal,, said acquisition means sending an acquisition command to said automatic call distributor to switch said acquired agent from servicing inbound telephone calls to servicing outbound telephone calls; and

releasing means for releasing said acquired inbound agent if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said releasing means sending a release command to said automatic call distributor to switch said acquired inbound agent from servicing outbound telephone calls to servicing inbound telephone calls so that said acquired inbound agent may resume servicing inbound telephone calls, whereby said acquired inbound agent is selectively acquired for and released from outbound telephone call servicing by sending commands to said automatic call distributor.

17. A system for maximizing call servicing quality by sharing a pool of agents handling inbound and outbound telephone calls on a telephone exchange having a plurality of trunk lines designated as dedicated inbound communication lines and a plurality of trunk lines designated as dedicated outbound communication lines, each agent having a telephone device, the system comprising:

an automatic call distributor to couple the inbound telephone calls to the telephone devices of a plurality of agents from the pool of agents designated as inbound agents, said automatic call distributor being coupled to the dedicated inbound communication lines to receive inbound telephone calls from the telephone exchange;

an outbound dialer to automatically place outbound telephone calls for a plurality of agents from the pool of agents designated as outbound agents, said outbound dialer being coupled to the telephone devices of said plurality of outbound agents to place outbound telephone calls onto the telephone exchange;

an analyzer to analyze inbound telephone calls and to determine a response indicator indicative of a level of service quality;

acquisition means for acquiring one of said inbound agents to service one or more outbound telephone calls using said outbound dialer if said response indicator indicates that said level of service quality exceeds a predetermined service quality goal; and

releasing means for releasing said acquired inbound agent if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, whereby said acquired inbound agent is selectively acquired for and released from servicing outbound telephone calls as said response indicator fluctuates above and below said predetermined service quality goal.

18. The system of claim 17 wherein said acquisition means uses said outbound dialer to place an acquisition telephone call to said acquired inbound agent through said automatic call distributor and said releasing means releases said acquired agent by

terminating said acquisition telephone call to said acquired agent so that said acquired agent may resume servicing inbound telephone calls.

19. The system of claim 17 wherein said acquisition means acquires said acquired agent by sending an acquisition command to said automatic call distributor and said releasing means releases said acquired agent by sending a release command to said automatic call distributor so that said acquired agent may resume servicing inbound telephone calls.

20. A system for maximizing call servicing productivity by sharing a pool of agents handling inbound and outbound telephone calls on a telephone exchange having a plurality of trunk lines designated as dedicated inbound communication lines and a plurality of trunk lines designated as dedicated outbound communication lines, each agent having a telephone device, the system comprising:

an automatic call distributor to couple the inbound telephone calls to the telephone devices of a plurality of agents from the pool of agents designated as inbound agents, said automatic call distributor being coupled to the dedicated inbound communication lines to receive inbound telephone calls from the telephone exchange;

an outbound dialer to automatically place outbound telephone calls for a plurality of agents from the pool of agents designated as outbound agents, said outbound dialer being coupled to the telephone devices of said plurality of outbound agents to place outbound telephone calls onto the telephone exchange;

an analyzer to analyze inbound telephone calls to determine agent productivity;

acquisition means for acquiring one of said inbound agents to service one or more outbound telephone calls using said outbound dialer if said productivity is less than a predetermined productivity goal, said acquisition means using said outbound dialer to place an acquisition telephone call to said acquired agent through said automatic call distributor; and

releasing means for releasing said acquired inbound agent if said productivity exceeds said predetermined productivity goal, said releasing means terminating said acquisition telephone call to said acquired inbound agent through said automatic call distributor so that said acquired inbound agent may resume servicing inbound telephone calls, whereby said acquired inbound agent is selectively acquired for and released from servicing outbound telephone calls as said productivity fluctuates below and above said predetermined productivity goal.

21. The system of claim 20 wherein said acquisition means uses said outbound dialer to place an acquisition telephone call to said acquired inbound agent and said

releasing means releases said acquired agent by terminating said acquisition telephone call to said acquired agent so that said acquired agent may resume servicing inbound telephone calls.

22. The system of claim 20 wherein said acquisition means acquires said acquired agent by sending an acquisition command to the automatic call distributor and said releasing means releases said acquired agent by sending a release command to the automatic call distributor so that said acquired agent may resume servicing inbound telephone calls.

23. A system for simultaneously maximizing productivity and call servicing quality by sharing pools of agents handling inbound and outbound telephone calls on a telephone exchange, each agent having a telephone device, the system comprising:

a plurality of trunk lines designated as dedicated inbound communication lines and coupled to the telephone exchange to receive inbound telephone calls;

a plurality of trunk lines designated as dedicated outbound communication lines and coupled to the telephone exchange to place outbound telephone calls;

an automatic call distributor coupled to said dedicated inbound communication lines to receive inbound telephone calls from the telephone exchange and couple the inbound telephone calls to the telephone devices of the agent pool containing a plurality of inbound agents and containing at least one blend agent, said blend agent being designated to service both inbound and outbound telephone calls as needed;

an outbound dialer coupled to said dedicated outbound communication lines to automatically place outbound telephone calls for a plurality of agents in the agent pool designated as outbound agents and for said blend agent when servicing outbound telephone calls;

an analyzer to analyze inbound telephone calls, to determine a response indicator indicative of a level of service quality, and to determine agent productivity;

acquisition means for acquiring a blend agent from the pool of agents to service one or more outbound telephone calls if said response indicator indicates that said level of service quality exceeds a predetermined service quality goal and said productivity is less than a predetermined productivity goal, said acquisition means using said outbound dialer to place an acquisition telephone call to said acquired blend agent; and

releasing means for releasing said acquired agent if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said releasing means terminating said acquisition telephone call, whereby said acquired agent is selectively acquired for and released from outbound telephone call servicing by establishing and terminating a telephone call using said outbound dialer and said automatic call distributor.

24. The system of claim 23 wherein said automatic call distributor initially couples inbound telephone calls to the telephone devices of said plurality of inbound agents until all of said plurality of inbound agents are servicing inbound telephone calls before coupling any inbound telephone calls to the telephone devices of said blend agents.

25. The system of claim 23, further including a switch to computer interface coupled to said automatic call distributor to monitor the status of said dedicated inbound communication lines, the status of said dedicated outbound communication lines, and the status of said inbound agents, said blend agents and said outbound agents.

26. A system for simultaneously maximizing productivity and call servicing quality by sharing pools of agents handling inbound and outbound telephone calls on a telephone exchange, each agent having a telephone device, the system comprising:

a plurality of trunk lines designated as dedicated inbound communication lines and coupled to the telephone exchange to receive inbound telephone calls;

a plurality of trunk lines designated as dedicated outbound communication lines and coupled to the telephone exchange to place outbound telephone calls;

an automatic call distributor coupled to said dedicated inbound communication lines to receive inbound telephone calls from the telephone exchange and couple the inbound telephone calls to the telephone devices of the agent pool containing a plurality of inbound agents and containing at least one blend agent, said blend agent being designated to service both inbound and outbound telephone calls as needed;

an outbound dialer coupled to said dedicated outbound communication lines to automatically place outbound telephone calls for a plurality of agents in the agent pool designated as outbound agents and for said blend agent when servicing outbound telephone calls;

an analyzer to analyze inbound telephone calls, to determine a response indicator indicative of a level of service quality, and to determine agent productivity;

acquisition means for acquiring a blend agent from the pool of agents to service one or more outbound telephone calls if said response indicator indicates that said level of service quality exceeds a predetermined service quality goal and said productivity is less than a predetermined productivity goal, said acquisition means sending an acquisition command to said automatic call distributor to switch said acquired agent from servicing inbound telephone calls to servicing outbound telephone calls; and

releasing means for releasing said acquired agent if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said releasing means sending a release command to said automatic call distributor to switch

said acquired inbound agent from servicing outbound telephone calls to servicing inbound telephone calls so that said acquired inbound agent may resume servicing inbound telephone calls, whereby said acquired inbound agent is selectively acquired for and released from outbound telephone call servicing by sending commands to said automatic call distributor.

27. A system for simultaneously maximizing productivity and call servicing quality by sharing pools of agents handling inbound and outbound telephone calls on a telephone exchange, each agent having a telephone device, the system comprising:

a plurality of trunk lines designated as dedicated inbound communication lines and coupled to the telephone exchange to receive inbound telephone calls;

a plurality of trunk lines designated as dedicated outbound communication lines and coupled to the telephone exchange to place outbound telephone calls;

an automatic call distributor coupled to said dedicated inbound communication lines to receive inbound telephone calls from the telephone exchange and couple the inbound telephone calls to the telephone devices of the agent pool containing a plurality of blend agents, said blend agents being designated to service both inbound and outbound telephone calls as needed;

an outbound dialer coupled to said dedicated outbound communication lines to automatically place outbound telephone calls for said blend agents when said blend agents are servicing outbound telephone calls;

an analyzer to analyze inbound telephone calls, to determine a response indicator indicative of a level of service quality, and to determine agent productivity;

acquisition means for acquiring a blend agent from the pool of agents currently servicing inbound telephone calls to service one or more outbound telephone calls if said response indicator indicates that said level of service quality exceeds a predetermined service quality goal and said productivity is less than a predetermined productivity goal, said acquisition means using said outbound dialer to place an acquisition telephone call to said acquired blend agent; and

releasing means for releasing said acquired agent if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said releasing means terminating said acquisition telephone call, whereby said acquired agent is selectively acquired for and released from outbound telephone call servicing by establishing and terminating a telephone call using said outbound dialer and said automatic call distributor.

28. A system for simultaneously maximizing productivity and call servicing quality by sharing pools of agents handling inbound and outbound telephone calls on a telephone exchange, each agent having a telephone device, the system comprising:

a plurality of trunk lines designated as dedicated inbound communication lines and coupled to the telephone exchange to receive inbound telephone calls;

a plurality of trunk lines designated as dedicated outbound communication lines and coupled to the telephone exchange to place outbound telephone calls;

an automatic call distributor coupled to said dedicated inbound communication lines to receive inbound telephone calls from the telephone exchange and couple the inbound telephone calls to the telephone devices of the agent pool containing a plurality of blend agents, said blend agents being designated to service both inbound and outbound telephone calls as needed;

an outbound dialer coupled to said dedicated outbound communication lines to automatically place outbound telephone calls for said blend agents when said blend agents are servicing outbound telephone calls;

an analyzer to analyze inbound telephone calls, to determine a response indicator indicative of a level of service quality, and to determine agent productivity;

acquisition means for acquiring a blend agent from the pool of agents currently servicing inbound telephone calls to service one or more outbound telephone calls if said response indicator indicates that said level of service quality exceeds a predetermined service quality goal and said productivity is less than a predetermined productivity goal, said acquisition means sending an acquisition command to said automatic call distributor to switch said acquired agent from servicing inbound telephone calls to servicing outbound telephone calls; and

releasing means for releasing said acquired agent if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said releasing means sending a release command to said automatic call distributor to switch said acquired inbound agent from servicing outbound telephone calls to servicing inbound telephone calls so that said acquired inbound agent may resume servicing inbound telephone calls, whereby said acquired agent is selectively acquired for and released from outbound telephone call servicing by sending commands to said automatic call distributor.

29. A system for simultaneously maximizing productivity and call servicing quality by sharing pools of agents handling inbound telephone calls on a telephone exchange, each agent having a telephone device, the system comprising:

a plurality of trunk lines designated as dedicated inbound communication lines and coupled to the telephone exchange to receive inbound telephone calls;

an automatic call distributor coupled to said dedicated inbound communication lines to receive inbound telephone calls from the telephone exchange and couple the inbound telephone calls to the telephone devices of the agent pool containing a plurality of inbound

agents and containing at least one blend agent, said blend agent being designated to service both inbound and outbound telephone calls as needed;

an analyzer to analyze inbound telephone calls, to determine a response indicator indicative of a level of service quality, and to determine agent productivity;

acquisition means for acquiring a blend agent from the pool of agents to provide alternate service activities if said response indicator indicates that said level of service quality exceeds a predetermined service quality goal and said productivity is less than a predetermined productivity goal, said acquisition means using said outbound dialer to place an acquisition telephone call to said acquired blend agent; and

releasing means for releasing said acquired agent if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said releasing means terminating said acquisition telephone call, whereby said acquired agent is selectively acquired for and released from alternate service activities by establishing and terminating a telephone call using said outbound dialer and said automatic call distributor.

30. A system for simultaneously maximizing productivity and call servicing quality by sharing pools of agents handling inbound telephone calls on a telephone exchange, each agent having a telephone device, the system comprising:

a plurality of trunk lines designated as dedicated inbound communication lines and coupled to the telephone exchange to receive inbound telephone calls;

an automatic call distributor coupled to said dedicated inbound communication lines to receive inbound telephone calls from the telephone exchange and couple the inbound telephone calls to the telephone devices of the agent pool containing a plurality of inbound agents and containing at least one blend agent, said blend agent being designated to service both inbound and outbound telephone calls as needed;

an analyzer to analyze inbound telephone calls, to determine a response indicator indicative of a level of service quality, and to determine agent productivity;

acquisition means for acquiring a blend agent from the pool of agents to provide alternate service activities if said response indicator indicates that said level of service quality exceeds a predetermined service quality goal and said productivity is less than a predetermined productivity goal, said acquisition means sending an acquisition command to said automatic call distributor to switch said acquired agent from servicing inbound telephone calls to providing alternate service activities; and

releasing means for releasing said acquired agent if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said releasing means sending a release command to said automatic call distributor to switch said acquired inbound agent from providing alternate service activities to servicing inbound

telephone calls so that said acquired inbound agent may resume servicing inbound telephone calls, whereby said acquired agent is selectively acquired for and released from alternate service activities by sending commands to said automatic call distributor.

31. A system for simultaneously maximizing productivity and call servicing quality by sharing pools of agents handling inbound and outbound telephone calls on a telephone exchange having a plurality of trunk lines designated as dedicated inbound communication lines and a plurality of trunk lines designated as dedicated outbound communication lines, each agent having a telephone device, the system comprising:

an automatic call distributor coupled to the dedicated inbound communication lines to receive inbound telephone calls from the telephone exchange and couple the inbound telephone calls to the telephone devices of the agent pool containing a plurality of inbound agents and containing at least one blend agent, said blend agent being designated to service both inbound and outbound telephone calls as needed;

an outbound dialer coupled to the dedicated outbound communication lines to automatically place outbound telephone calls for a plurality of agents in the agent pool designated as outbound agents and for said blend agent when servicing outbound telephone calls;

an analyzer to analyze inbound telephone calls, to determine a response indicator indicative of a level of service quality, and to determine agent productivity;

acquisition means for acquiring a blend agent from the pool of agents to service one or more outbound telephone calls if said response indicator indicates that said level of service quality exceeds a predetermined service quality goal and said productivity is less than a predetermined productivity goal, said acquisition means using said outbound dialer to place an acquisition telephone call to said acquired blend agent; and

releasing means for releasing said acquired agent if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said releasing means terminating said acquisition telephone call, whereby said acquired agent is selectively acquired for and released from outbound telephone call servicing by establishing and terminating a telephone call using said outbound dialer and said automatic call distributor.

32. The system of claim 31 wherein said automatic call distributor initially couples inbound telephone calls to the telephone devices of said plurality of inbound agents until all of said plurality of inbound agents are servicing inbound telephone calls before coupling any inbound telephone calls to the telephone devices of said blend agents.

33. The system of claim 31, further including a switch to computer interface coupled to said automatic call distributor to monitor the status of the dedicated inbound communication lines, the status of the dedicated outbound communication lines, and the status of said inbound agents, said blend agents and said outbound agents.

34. A system for simultaneously maximizing productivity and call servicing quality by sharing a pool of agents handling inbound and outbound telephone calls on a telephone exchange having a plurality of trunk lines designated as dedicated inbound communication lines and a plurality of trunk lines designated as dedicated outbound communication lines, and an automatic call distributor coupled to the dedicated inbound communication lines to receive inbound telephone calls from the telephone exchange, the automatic call distributor having a switch to computer interface to allow the monitoring of the status of the automatic call distributor, each agent having a telephone device, the system comprising:

an outbound dialer coupled to the dedicated outbound communication lines to automatically place outbound telephone calls for a plurality of agents from the pool of agents designated as outbound agents;

an analyzer coupled to the automatic call distributor through the switch to computer interface to analyze inbound telephone calls, compile a set of statistics relating to inbound telephone calls, to determine a response indicator indicative of a level of service quality, and to determine agent productivity;

acquisition means for acquiring one of said plurality of inbound agents to service outbound telephone calls if said response indicator indicates that said level of service quality exceeds a predetermined service quality goal and said productivity is less than a predetermined productivity goal; and

releasing means for releasing said acquired inbound agent if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, whereby said acquired inbound agent is selectively acquired for and released from outbound telephone call servicing as said response indicator and said productivity fluctuate.

35. A system for simultaneously maximizing productivity and call servicing quality by sharing a pool of agents handling inbound telephone calls on a telephone exchange having a plurality of trunk lines designated as dedicated inbound communication lines and an automatic call distributor coupled to the dedicated inbound communication lines to receive inbound telephone calls from the telephone exchange, the automatic call distributor having a

switch to computer interface to allow the monitoring of the status of the automatic call distributor, each agent having a telephone device, the system comprising:

an analyzer coupled to the automatic call distributor through the switch to computer interface to analyze inbound telephone calls, compile a set of statistics relating to inbound telephone calls, to determine a response indicator indicative of a level of service quality, and to determine agent productivity;

acquisition means for acquiring one of said plurality of inbound agents to provide alternate service activities if said response indicator indicates that said level of service quality exceeds a predetermined service quality goal and said productivity is less than a predetermined productivity goal; and

releasing means for releasing said acquired inbound agent if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, whereby said acquired inbound agent is selectively acquired for and released from alternative service activities as said response indicator and said productivity fluctuate.

36. The system of claim 34 wherein said acquisition means uses said outbound dialer to place an acquisition telephone call to said acquired inbound agent and said releasing means releases said acquired agent by terminating said acquisition telephone call to said acquired agent so that said acquired agent may resume servicing inbound telephone calls.

37. The system of claim 34 wherein said acquisition means acquires said acquired agent by sending an acquisition command to the automatic call distributor and said releasing means releases said acquired agent by sending a release command to the automatic call distributor so that said acquired agent may resume servicing inbound telephone calls.

38. A system for simultaneously maximizing productivity and call servicing quality by sharing a pool of agents handling inbound and outbound telephone calls on a telephone exchange having a plurality of trunk lines designated as dedicated inbound communication lines and a plurality of trunk lines designated as dedicated outbound communication lines, each agent having a telephone device, the system comprising:

a first switch to couple telephone calls between the telephone exchange and the telephone devices of the pool of agents, said first switch having at least a first network connection, said network connection coupling said first switch to the telephone exchange;

a second switch to couple telephone calls between the telephone exchange and the telephone devices of the pool of agents, said second switch having at least a first switching network connection, said switching network connection coupling said second switch to the telephone exchange;

dialer means for dialing outbound telephone calls associated with said first or second switches; and

transfer means for transferring an agent initially coupled to the telephone exchange through said first switch to couple said transferred agent to the telephone exchange through said second switch, said transferred agent being coupled to said second switch by said dialer placing an agent acquisition telephone call.

39. A system for simultaneously maximizing productivity and call servicing quality by sharing a pool of agents handling inbound telephone calls on a telephone exchange having a plurality of trunk lines designated as dedicated inbound communication lines, each agent having a telephone device, the system comprising:

an automatic call distributor to couple the inbound telephone calls to the telephone devices of a plurality of agents from the pool of agents designated as inbound agents, said automatic call distributor being coupled to the dedicated inbound communication lines to receive inbound telephone calls from the telephone exchange;

an analyzer to analyze inbound telephone calls, compile a set of statistics relating to inbound telephone calls, to determine a response indicator indicative of a level of service quality, and to determine agent productivity;

acquisition means for acquiring one of said inbound agents to provide alternate service activities if said response indicator indicates that said level of service quality exceeds a predetermined service quality goal and said productivity is less than a predetermined productivity goal, said acquisition means using said automatic call distributor to acquire one of said inbound agents; and

releasing means for releasing said acquired inbound agent if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said releasing means using said automatic call distributor to release said one acquired agent, whereby said acquired inbound agent is selectively acquired for and released from alternate service activities using said automatic call distributor.

40. The system of claim 39, further including an outbound dialer to automatically place outbound telephone calls for said acquired agent on a trunk line designated as a dedicated outbound communications line, said alternate activity being servicing of outbound telephone calls.

41. The system of claim 40 wherein said outbound dialer is a predictive outbound dialer, said outbound dialer automatically changing the rate of outbound telephone calls as said acquired agent is acquired or released.

42. The system of claim 39 wherein said analyzer compiles a set of statistics relating to the inbound telephone calls and uses said compiled statistics to measure said level of service quality.

43. The system of claim 42 wherein said compiled statistics includes a value indicative of the wrap-up time required by said inbound agents to process data after termination of inbound telephone calls, said analyzer determining said value based on measured wrap-up times and imputed wrap-up times whenever said measured wrap-up time is not available, said imputed wrap-up times being a fraction of said value.

44. The system of claim 42 wherein said compiled statistics include the number of said inbound agents available to service inbound telephone calls, said analyzer determining the number of said available inbound agents by comparing a work time for a particular one of said inbound agents with an average work time and declaring said particular agent unavailable if said work time for said particular agent exceeds said average work time by a predetermined amount.

45. The system of claim 39, further including a switch to computer interface coupled to said automatic call distributor to monitor the status of said dedicated inbound communication lines and the status of said inbound and said acquired agents.

46. A method of simultaneously maximizing productivity and call servicing quality by sharing a pool of agents coupled to an automatic call distributor with an outbound dialer, each agent having a telephone device, the method comprising the steps of:

(a) creating a pool of inbound agents with telephone devices coupled to a plurality of trunk lines designated as dedicated inbound communication lines to process inbound telephone calls, a pool of outbound agents with telephone devices coupled to a plurality of trunk lines designated as dedicated outbound communication lines to process outbound telephone calls, and a pool of blend agents designated as either inbound or outbound agents, the telephone devices of said blend agents alternatively coupled to either said dedicated inbound communication lines or said dedicated outbound communication lines to selectively service either inbound or outbound telephone calls;

(b) determining a level of productivity for said inbound agents, said outbound agents, and said blend agents;

(c) determining a response indicator indicative of a level of service quality;

(d) if said productivity is less than a predetermined productivity goal and said response indicator indicates that said level of service quality exceeds a predetermined service quality goal, using the outbound dialer to place an acquisition telephone call to one of said blend agents who is currently servicing inbound telephone calls; and

(e) upon connection of said internal call to said one blend agent, acquiring said one blend agent to service outbound calls placed by the outbound dialer, whereby said one blend agent is coupled to the outbound dialer through a trunk line coupling the outbound dialer to the automatic call distributor.

47. The method of claim 46, further including the step of compiling a set of statistics relating to said inbound telephone calls, said statistics being used to measure said level of productivity and to determine said response indicator.

48. The method of claim 46, further including the step of:

(f) releasing said one blend agent by terminating said acquisition telephone call if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said one blend agent returning to servicing inbound telephone calls, whereby said one blend agent is selectively acquired for and released from outbound telephone call servicing by establishing and terminating an acquisition telephone call using the outbound dialer and the automatic call distributor.

49. The method of claim 46, further including the step of directing inbound telephone calls to said pool of inbound agents until each of the agents in said pool of inbound agents is servicing inbound telephone calls, and then directing additional inbound telephone calls to said pool of blend agents.

50. A method of simultaneously maximizing productivity and call servicing quality by sharing a pool of agents coupled to an automatic call distributor with an outbound dialer, each agent having a telephone device, the method comprising the steps of:

(a) determining a level of productivity for the pool of agents;

(b) determining a response indicator indicative of a level of service quality;

(c) if said productivity is less than a predetermined productivity goal and said response indicator indicates that said level of service quality exceeds a predetermined service quality goal, using the outbound dialer to place an acquisition telephone call to one of the agents in the pool of agents who is currently servicing inbound telephone calls; and

(d) upon connection of said internal call to said one agent, acquiring said one agent to service outbound calls placed by the outbound dialer, whereby said one agent is

coupled to the outbound dialer through a trunk line coupling the outbound dialer to the automatic call distributor.

51. The method of claim 50, further including the step of compiling a set of statistics relating to said inbound telephone calls, said statistics being used to measure said level of productivity and to determine said response indicator.

52. The method of claim 50, further including the step of:

(e) releasing said one agent by terminating said acquisition telephone call if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said one blend agent returning to servicing inbound telephone calls, whereby said one agent is selectively acquired for and released from outbound telephone call servicing by establishing and terminating an acquisition telephone call using the outbound dialer and the automatic call distributor.

53. A method of simultaneously maximizing productivity and call servicing quality by sharing a pool of agents coupled to an automatic call distributor with an outbound dialer, each agent having a telephone device, the method comprising the steps of:

(a) determining a level of productivity for the pool of agents;

(b) determining a response indicator indicative of a level of service quality;

(c) if said productivity is less than a predetermined productivity goal and said response indicator indicates that said level of service quality exceeds a predetermined service quality goal, sending an acquisition command to the automatic call distributor to switch one of said agents who is currently servicing inbound telephone calls to service outbound telephone calls, whereby said one agent is coupled to the outbound dialer through the automatic call distributor.

54. The method of claim 53, further including the step of compiling a set of statistics relating to said inbound telephone calls, said statistics being used to measure said level of productivity and to determine said response indicator.

55. The method of claim 53, further including the step of:

(d) releasing said one agent by sending a release command to the automatic call distributor if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said one blend agent returning to servicing inbound telephone calls, whereby said one agent is selectively acquired for and released from outbound

telephone call servicing by sending acquisition commands and release commands to the automatic call distributor.

56. A method of simultaneously maximizing productivity and call servicing quality by sharing a pool of agents coupled to an automatic call distributor with an outbound dialer, each agent having a telephone device, the method comprising the steps of:

(a) determining a level of productivity for the pool of agents;

(b) determining a response indicator indicative of a level of service quality;

(c) if said productivity is less than a predetermined productivity goal and said response indicator indicates that said level of service quality exceeds a predetermined service quality goal, using the outbound dialer to place an acquisition telephone call to one of the agents in the pool of agents who is currently servicing inbound telephone calls; and

(d) upon connection of said internal call to said one agent, acquiring said one agent to provide alternate service activities, whereby said one agent may perform inbound call servicing or alternate service activities.

57. The method of claim 56, further including the step of compiling a set of statistics relating to said inbound telephone calls, said statistics being used to measure said level of productivity and to determine said response indicator.

58. The method of claim 57, further including the step of determining an agent wrap-up time by estimating said wrap-up time as a fraction of an average wrap-up time.

59. The method of claim 57, further including the step of determining the number of agents available to service inbound telephone calls by comparing a measured work time for a particular agent from the pool of agents to an average work time, said particular agent being classified as unavailable if said measured work time exceeds said average work time by a predetermined amount.

60. The method of claim 56, further including the step of:

(e) releasing said one agent by terminating said acquisition telephone call if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said one blend agent returning to servicing inbound telephone calls, whereby said one agent is selectively acquired for and released from alternate service activities by establishing and terminating an acquisition telephone call using the outbound dialer and the automatic call distributor.

61. A method of simultaneously maximizing productivity and call servicing quality by sharing a pool of agents coupled to an automatic call distributor, each agent having a telephone device, the method comprising the steps of:

(a) determining a level of productivity for the pool of agents;

(b) determining a response indicator indicative of a level of service quality;

(c) if said productivity is less than a predetermined productivity goal and said response indicator indicates that said level of service quality exceeds a predetermined service quality goal, sending an acquisition command to the automatic call distributor to acquire one of the agents in the pool of agents who is currently servicing inbound telephone calls; and

(d) using said one agent to provide alternate service activities, whereby said one agent may perform inbound call servicing or alternate service activities.

62. The method of claim 61, further including the step of compiling a set of statistics relating to said inbound telephone calls, said statistics being used to measure said level of productivity and to determine said response indicator.

63. The method of claim 62, further including the step of determining an agent wrap-up time by estimating said wrap-up time as a fraction of an average wrap-up time.

64. The method of claim 62, further including the step of determining the number of agents available to service inbound telephone calls by comparing a measured work time for a particular agent from the pool of agents to an average work time, said particular agent being classified as unavailable if said measured work time exceeds said average work time by a predetermined amount.

65. The method of claim 61, further including the step of:

(e) releasing said one agent by sending a release command to the automatic call distributor if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said one blend agent returning to servicing inbound telephone calls, whereby said one agent is selectively acquired for and released from alternate service activities by sending acquisition commands and release commands to the automatic call distributor.

66. A method of maximizing call servicing quality by sharing a pool of agents coupled to an automatic call distributor, each agent having a telephone device, the method comprising the steps of:

(a) determining a response indicator indicative of a level of service quality;

(b) if said response indicator indicates that said level of service quality exceeds a predetermined service quality goal, acquiring one of the agents in the pool of agents who is currently servicing inbound telephone calls; and

(c) upon acquisition of said one agent, using said one agent to provide alternate service activities, whereby said one agent may perform inbound call servicing or alternate service activities.

67. The method of claim 66, further including the step of:

(d) releasing said one agent if said response indicator indicates that said level of service quality is less than said predetermined service quality goal, said one agent returning to servicing inbound telephone calls, whereby said one agent is selectively acquired for and released from alternate service activities as said response indicator fluctuates above and below said predetermined service quality goal.

68. The method of claim 67 wherein step (b) of acquiring said one agent is accomplished by placing an acquisition telephone call through the automatic call distributor to said one agent, and step (d) of releasing said one agent is accomplished by terminating said acquisition telephone call.

69. The method of claim 67 wherein step (b) of acquiring said one agent is accomplished by sending an acquisition command to the automatic call distributor to said one agent, and step (d) of releasing said one agent is accomplished by sending a release command to the automatic call distributor.

70. The method of claim 66, further including the step of compiling a set of statistics relating to said inbound telephone calls, said statistics being used to measure said level of productivity and to determine said response indicator.

71. A method of maximizing productivity by sharing a pool of agents coupled to an automatic call distributor, each agent having a telephone device, the method comprising the steps of:

(a) determining a level of productivity for the pool of agents;

(b) if said productivity is less than a predetermined productivity goal, acquiring one of the agents in the pool of agents who is currently servicing inbound telephone calls; and

(c) upon acquisition of said one agent, using said one agent to provide alternate service activities, whereby said one agent may perform inbound call servicing or alternate service activities.

72. The method of claim 71, further including the step of:

(d) releasing said one agent if said productivity exceeds said predetermined productivity goal, said one agent returning to servicing inbound telephone calls, whereby said one agent is selectively acquired for and released from alternate service activities as said productivity fluctuates below and above said predetermined productivity goal.

73. The method of claim 72 wherein step (b) of acquiring said one agent is accomplished by placing an acquisition telephone call through the automatic call distributor to said one agent, and step (d) of releasing said one agent is accomplished by terminating said acquisition telephone call.

74. The method of claim 72 wherein step (b) of acquiring said one agent is accomplished by sending an acquisition command to the automatic call distributor to said one agent, and step (d) of releasing said one agent is accomplished by sending a release command to the automatic call distributor.

75. The method of claim 71, further including the step of compiling a set of statistics relating to said inbound telephone calls, said statistics being used to measure said level of productivity and to determine said response indicator.

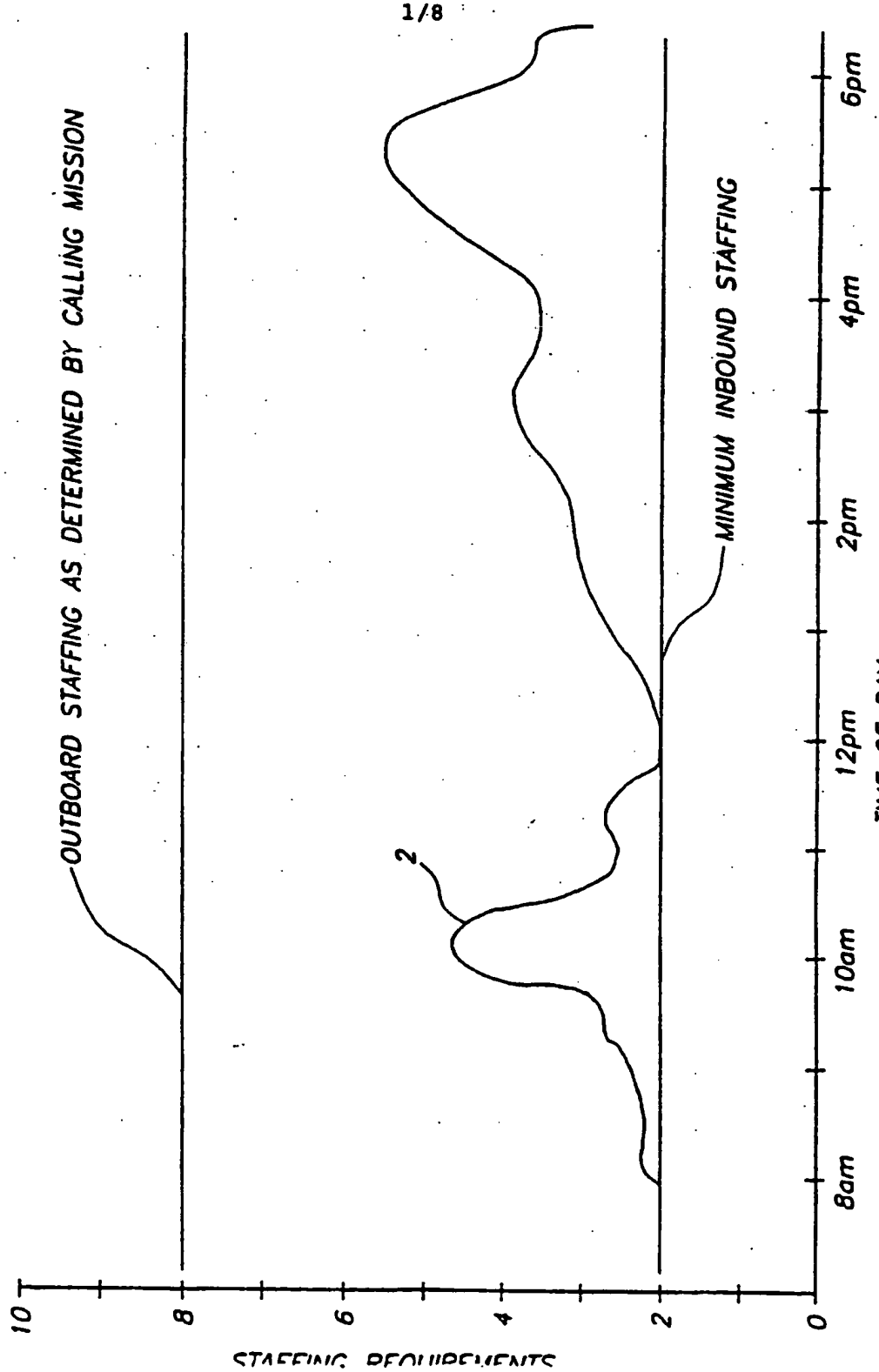
OUTBOARD STAFFING AS DETERMINED BY CALLING MISSION
MINIMUM INBOUND STAFFING
2
10
8
6
4
2
0
STAFFING REQUIREMENTS
8am
10am
12pm
2pm
4pm
6pm
TIME OF DAY

Figure 1

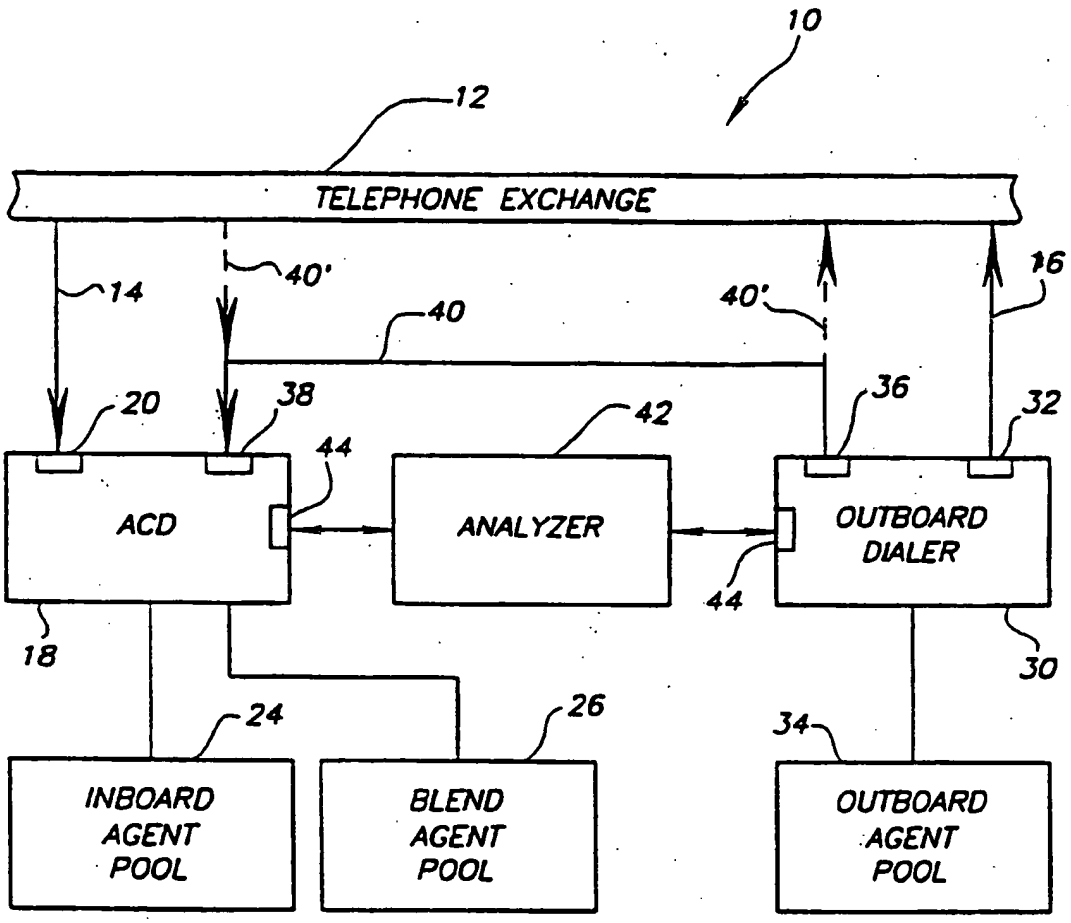
10
12
TELEPHONE EXCHANGE
14
40'
40
40'
16
20
38
42
36
32
44
ACD
ANALYZER
OUTBOARD DIALER
44
18
30
24
26
34
INBOARD AGENT POOL
BLEND AGENT POOL
OUTBOARD AGENT POOL

Figure 2

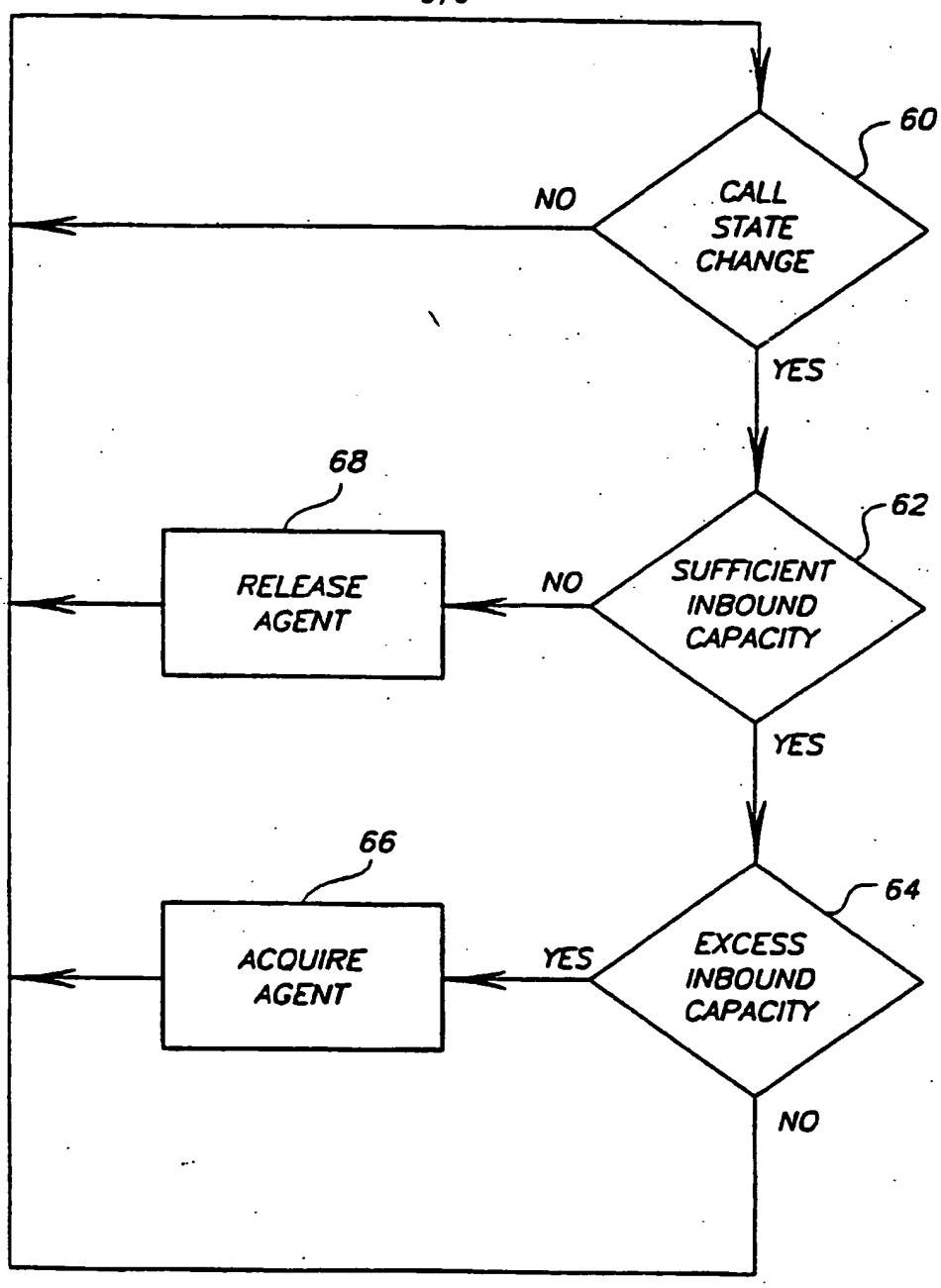
60
CALL STATE CHANGE
NO
YES
62
SUFFICIENT INBOUND CAPACITY
NO
YES
68
RELEASE AGENT
64
EXCESS INBOUND CAPACITY
YES
NO
66
ACQUIRE AGENT

Figure 3

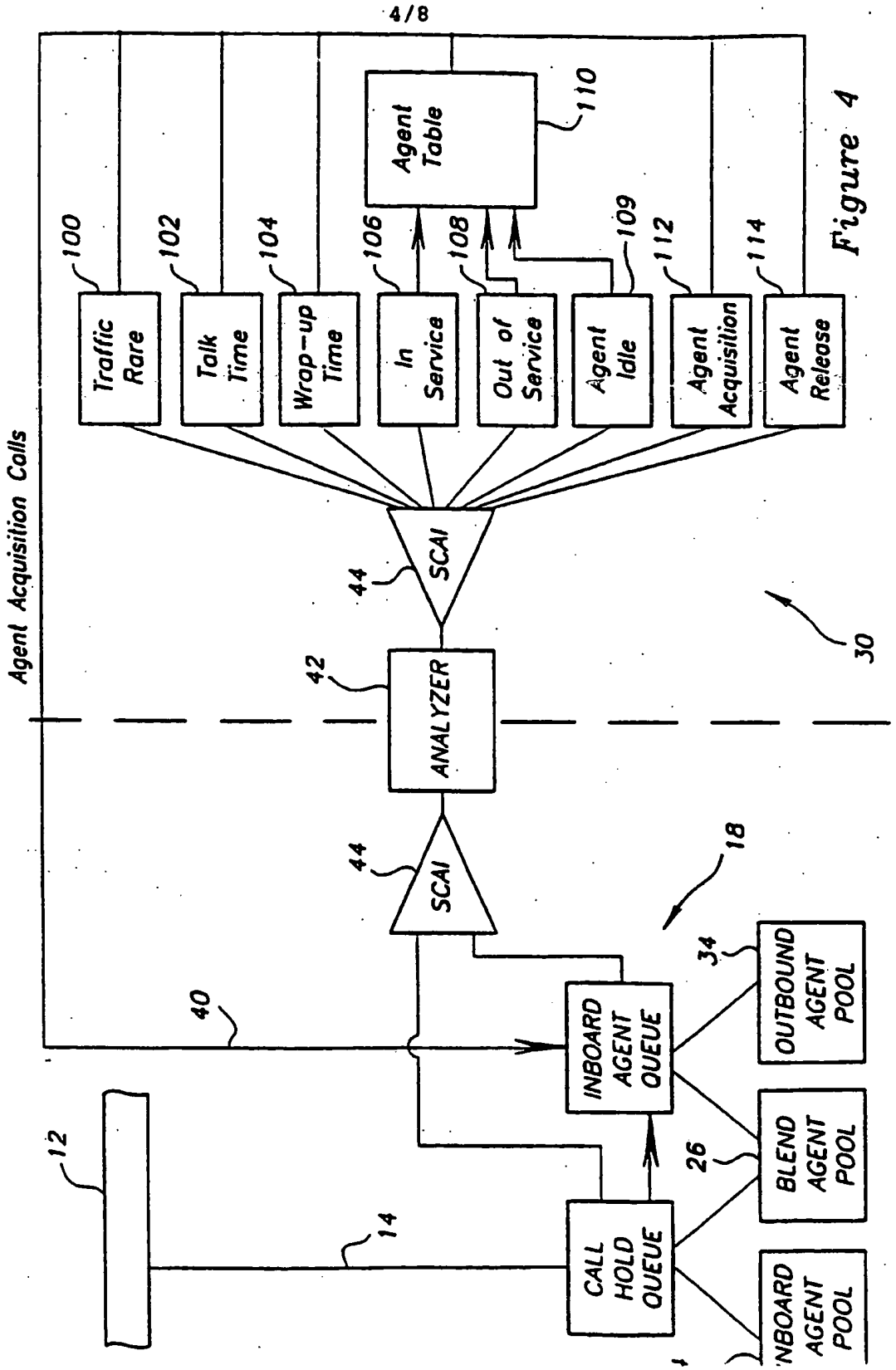
Agent Acquisition Calls
Traffic Rare
Talk Time
Wrap-up Time
In Service
Out of Service
Agent Idle
Agent Acquisition
Agent Release
Agent Table
100
102
104
106
108
109
110
112
114
SCAI
44
ANALYZER
42
30
18
40
INBOARD AGENT QUEUE
CALL HOLD QUEUE
OUTBOUND AGENT POOL
BLEND AGENT POOL
INBOARD AGENT POOL
34
26
12
14

Figure 4

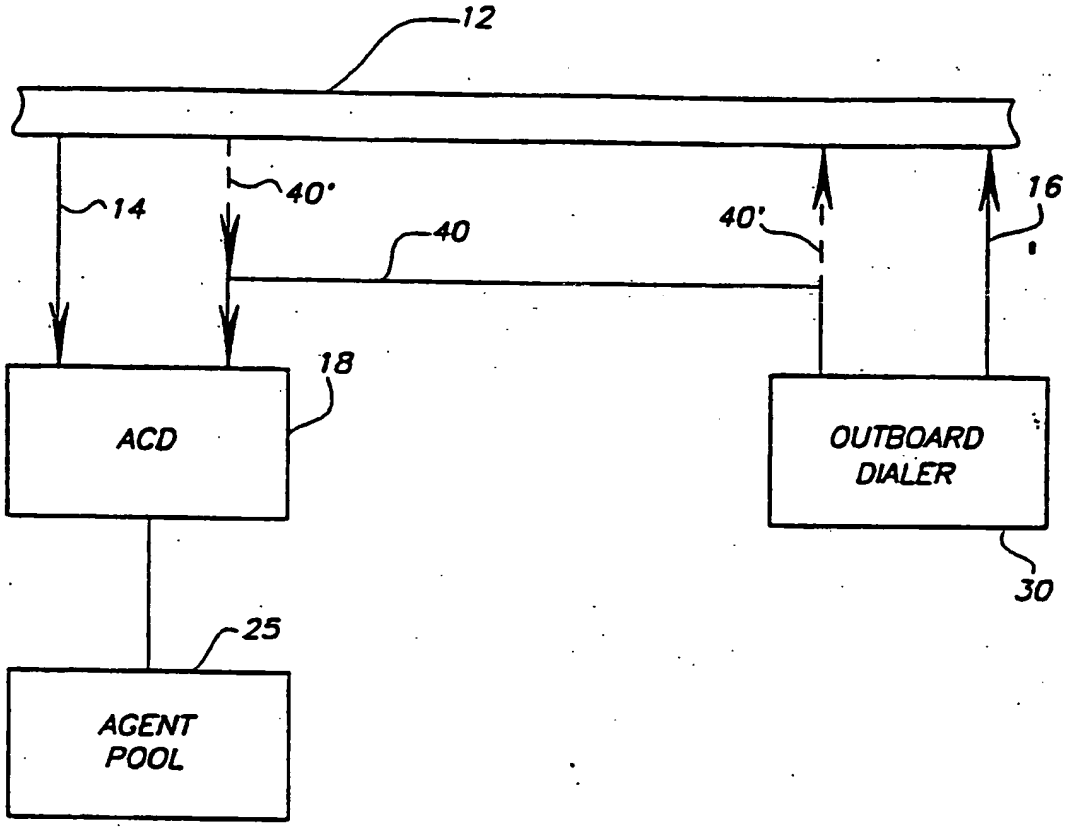

Figure 5A

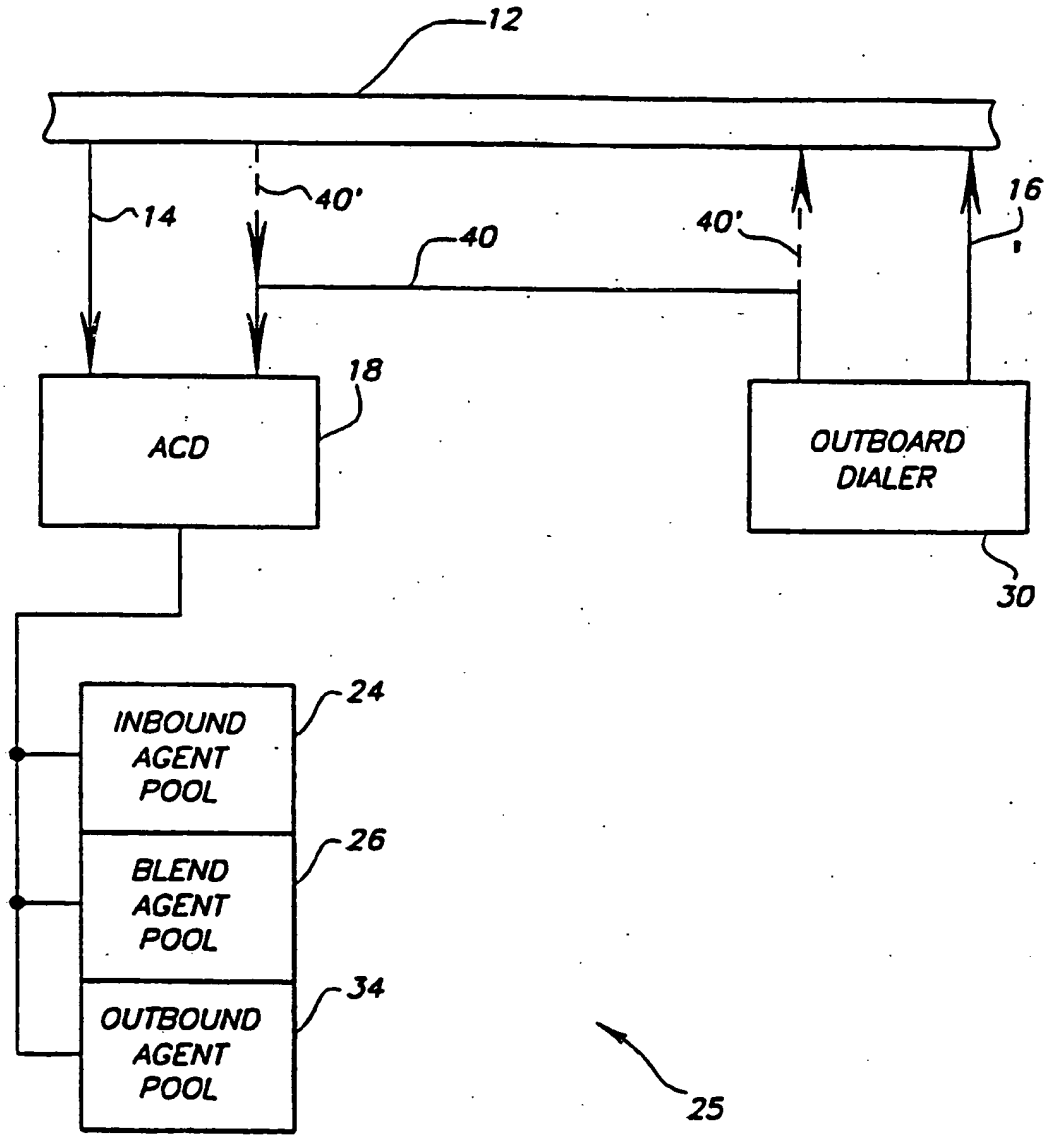
12
14
40'
40
40'
16
18
ACD
OUTBOARD DIALER
30
24
INBOUND AGENT POOL
26
BLEND AGENT POOL
34
OUTBOUND AGENT POOL
25

Figure 5B

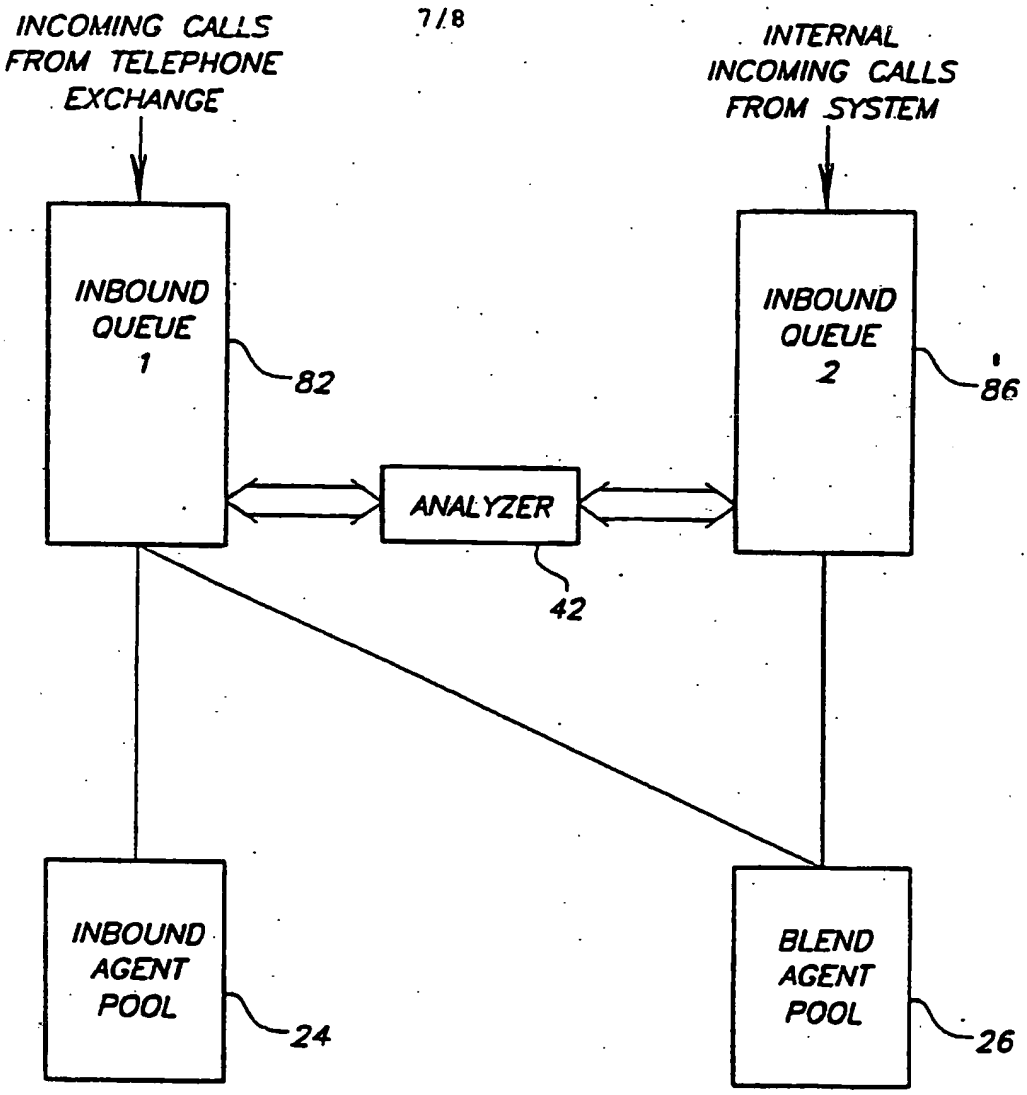
INCOMING CALLS FROM TELEPHONE EXCHANGE
INTERNAL INCOMING CALLS FROM SYSTEM
INBOUND QUEUE 1
82
INBOUND QUEUE 2
86
ANALYZER
42
INBOUND AGENT POOL
24
BLEND AGENT POOL
26

Figure 6A

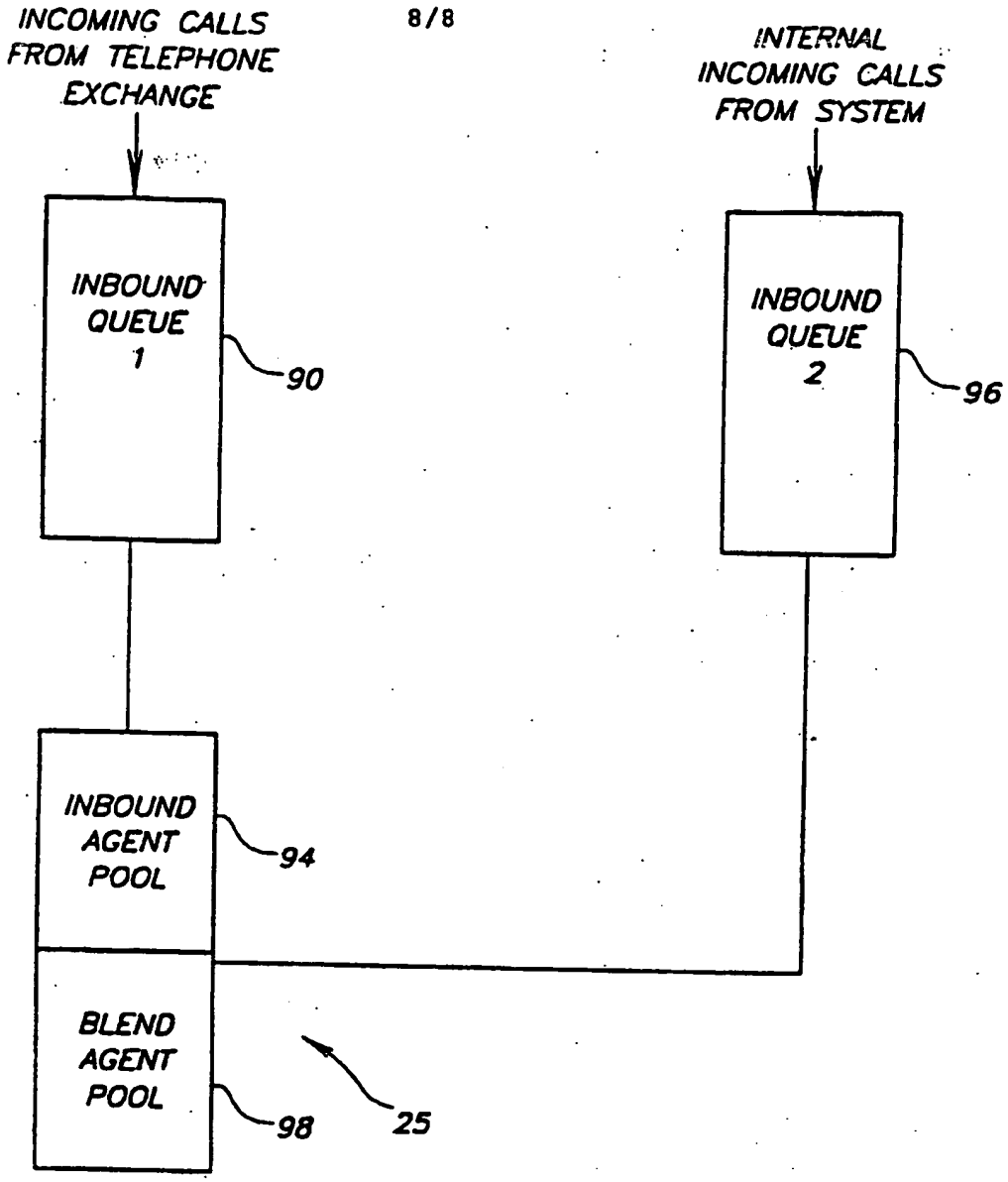
INCOMING CALLS FROM TELEPHONE EXCHANGE
INTERNAL INCOMING CALLS FROM SYSTEM
INBOUND QUEUE 1
90
INBOUND QUEUE 2
96
INBOUND AGENT POOL
94
BLEND AGENT POOL
98
25

Figure 6B

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 93/03307

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 H04M3/64; H04M3/46; H04M3/36

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	H04M

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category[10]	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	EP,A,0 460 816 (INVENTIONS INC.) 11 December 1991 see column 1, line 17 - column 4, line 13	1-75
A	US,A,4 896 345 (THORNE) 23 January 1990 see abstract	1-75
A	EP,A,0 340 665 (FUJITSU LIM.) 8 November 1989	

[10] Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
10 AUGUST 1993	20. 08. 93
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	VANDEVENNE M.J.

Form PCT/ISA/210 (second sheet) (January 1985)

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. US 9303307 SA 73556

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 10/08/93

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
EP-A-0460816	11-12-91	US-A-	5214688	25-05-93
		AU-B-	636978	13-05-93
		AU-A-	7642091	12-12-91
		CA-A-	2041882	06-12-91
US-A-4896345	23-01-90	None		
EP-A-0340665	08-11-89	JP-A-	1278156	08-11-89
		JP-A-	1318344	22-12-89
		JP-A-	1318343	22-12-89
		US-A-	4907256	06-03-90